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AMERICAN MACHINIST



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R A. BECKWITH, *Superintendent*
Koehring Company
Milwaukee, Wis

"I get information from articles and advertisements in *American Machinist* which often helps us in our manufacturing operations."

WHAT'S IN THIS ISSUE

THE TOOLMAKER SUGGESTS

Every toolmaker has, I am sure, prayed often and fervently for a tool designer who knows what it's all about, who can figure out which tolerances have to be close and which do not who never tries to put a guide pin and a drill bushing in the same hole What's more, I'll bet every toolmaker has at some time or other started for the engineering department with a ball pein hammer in his hand and murder in his heart

Thus it is a real pleasure to read over an article that spends its time talking the facts of life for tool designers G P Lehmann, of GE's Plastics Department at Pittsfield, Mass., does just that in talking about 'Mold Design for Plastics,' page 489 It tells one after another of the little things that are so important to the balance sheet the tricks that make the difference between profit and loss on a particular molding job

It's factual and practical, and shows that Mr Lehmann has had the practical experience at toolmaking that he privately feels every good tool designer must have under his belt



G. P LEHMANN

PRODUCTION CONTROL

Ten years ago, Chester Lord (then associate editor on AMERICAN MACHINIST) and I used to argue about management by the Exception Principle It was Chester's idea and he'd tried most of it in practice with good results that production departments should be organized on a progressive basis As long as parts came off the line without trouble, keeping things rolling was a clerical operation But when inaccuracies or shortages developed, executives were brought in to handle the problem, first the supervisor, then the foreman, and so on, as high as necessary to break the bottleneck

Chester is gone now but one of his ideas still sticks in mind that of a control board which would show everything about a production job at a glance Herbert Chase reports another example on page 495 a bar chart control board designed by S A Crosby, chief engineer of Speed Products Co., which utilizes lengths of colored cord to track thousands of small parts through various shop operations It's quickly adjustable gives a running check on what's going on and it's simple and economical to make It may be the answer to *your* production records problem

CART AND HORSE

So much has been written about the relative merits of various cutting materials, that considerations of their pros and cons often obscure the more basic problem of selecting the proper machine D W Mellor of Jones & Lamson endeavors to get horse and cart in proper relationship in 'What Tools for Turning,' beginning on page 496 It lists and discusses all the factors which must be considered in deciding between automatic lathe and turret lathe for a particular operation

FIERCEST

As the war drums roll, Uncle Sam begins to look to his defenses which today must include airplanes by the thousand And fiercest of his fighting planes is the Boeing flying fortress for which air armadas of the world have nothing but the greatest respect One immediate task is to produce the fortress on a production basis At the moment, Boeing is turning out one every four days, major credit for which must be given the huge steel jigs pictured on pages 498 and 499, which bring mass output advantages to limited lot construction

SIDNEY'S SOLUTION

All the bureaus and coordinating boards in the country can't turn out one good journeyman machinist because training a mechanic is a local and an individual problem It takes cooperation between local plants and local schools to provide the groundwork, then careful handling all along the line There must be proper balance of school theory and shop practice, of technical training and practical experience The small town of Sidney, Ohio, home of Monarch Machine Tool Co., faced just this problem and emerged with what Wendell E Whipp, Monarch's president, calls a practical solution But let Mr Whipp tell you about it, beginning on page 495



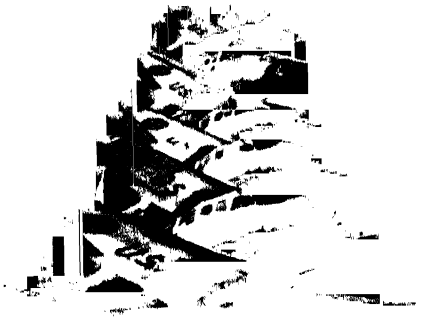
WENDELL E WHIPP

ALSO . . .

Joseph E Karash goes on with his series on die design discussing 'Tips for the Die Designer,' page 500 J G Magrath of Air Reduction discusses flame gouging in the second part of his article on modern applications of the oxyacetylene torch Also some tips on quick running in of new machines beginning on p 507

COMING

A humdinger is the article on apprenticeship in the manufacturing industries by Walter Simon Wisconsin State Supervisor of Apprenticeship Watch for it in AMERICAN MACHINIST for July 24 In the same issue will be top-notch articles on time quenching from Republic Steel how to hob small gears, the second part of our series on high temperature lubrication and the fourth of Mr Karash's series on die maintenance as well as another one of the extremely popular pages of 'Short Cuts for the Small Shop'





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SHAPERS — SHEARS — BRAKES — PRESSES

Practical molds for plastics

BY G. P. LEHMANN, PLASTICS DEPARTMENT, GENERAL ELECTRIC COMPANY

Well designed molds, properly constructed, are indispensable to trouble-free operation in a plastics plant. The designer should have molding experience

THERE ARE seven principal types of molds in use in the plastics industry. These are (1) the flash mold, (2) the landed plunger mold, (3) the loading plate mold, (4) the straight plunger mold, (5) the injection mold, (6) the transfer mold, and (7) the sub-cavity mold. Because it is uneconomical in the use of molding material, the sub-cavity type mold is not in common use.

The flash mold is the simplest to build and operate. It is therefore widely used. As shown in Fig. 1, this type of mold is characterized by a mold cavity, the sides of which terminate sharply on a level with the top surface of the lower mold member. The plunger completely enters the mold cavity, forcing the molding compound up the sides until the excess material is pinched off to a very thin fin or flash between the cutoff surfaces of plunger and cavity. The entire pressing force is supported by the horizontal meeting surfaces. It is wise to distribute this pressure over a larger area by leaving raised pads of approximately the same height as the cutoff surface.

When designing this type of mold keep the following considerations in mind. The cured compound exerts relatively high frictional resistance to the opening of a mold, so the top and bottom plates must be heavy enough and fastened securely enough to the mold parts to withstand the forces exerted by the pull-back cylinders. Also guide pins and guide pin bushings should be fastened securely. They must be so ground that they will position the two halves of the mold perfectly while allowing them to slip freely together.

The bottom steam retainer shoe should be provided with raised pads at the same height as the top of the cavity so as to distribute the pressure which otherwise would be concentrated on the cutoff surfaces of the mold cavity. Steam retainer shoes which frame the plunger and cavity should have the recesses which contain these members machined to exactly the same size, so that the plunger and cavity may be ground at the same time.

The designer should check the mechanical stresses in all parts of the mold, paying especial attention to the distance between parallels and adding extra supports in case they are found necessary. Knock-out bars should be checked to be certain that they will not bend under the stress of removing the molded part. Knock-out pins with well riveted heads should be fastened to this plate by the pin retainer plate, the holes in which should be enough larger than the pins that there will be allowance for the expansion of the mold when heated. Steam lines should be placed beneath the cavity wherever possible, but always around the cavity and plunger.

Clean-out slots must be provided between the top plate and the plunger retainer shoe if it is necessary that mold pins enter the plunger for proper line-up or for any other reason. Safety pins are used to prevent

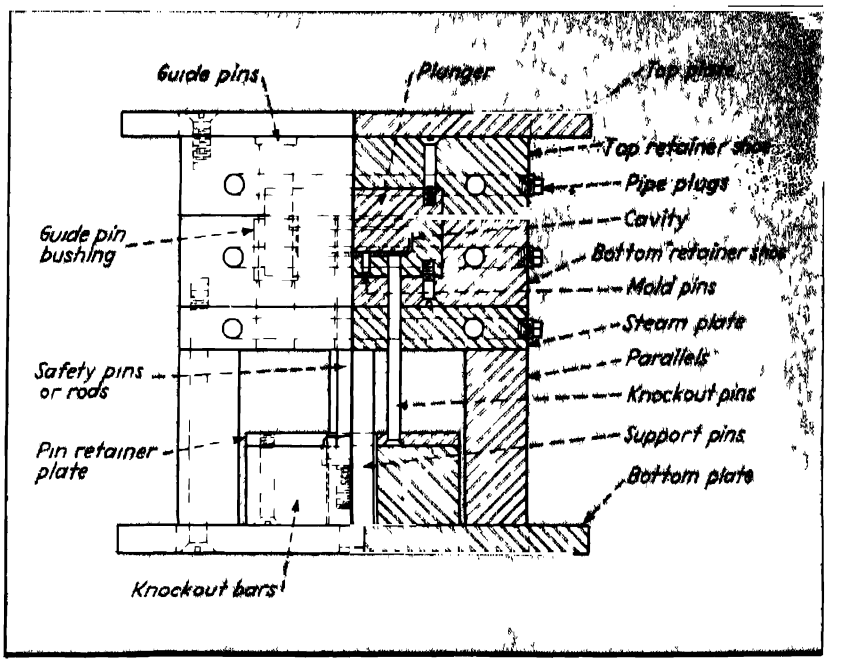


Fig. 1. Cavity in a flash type mold has sides which terminate sharply with the top surface of the lower mold member. Excess material is pinched off to a thin fin when the plunger has entered the mold cavity. These molds are simple to build and operate.

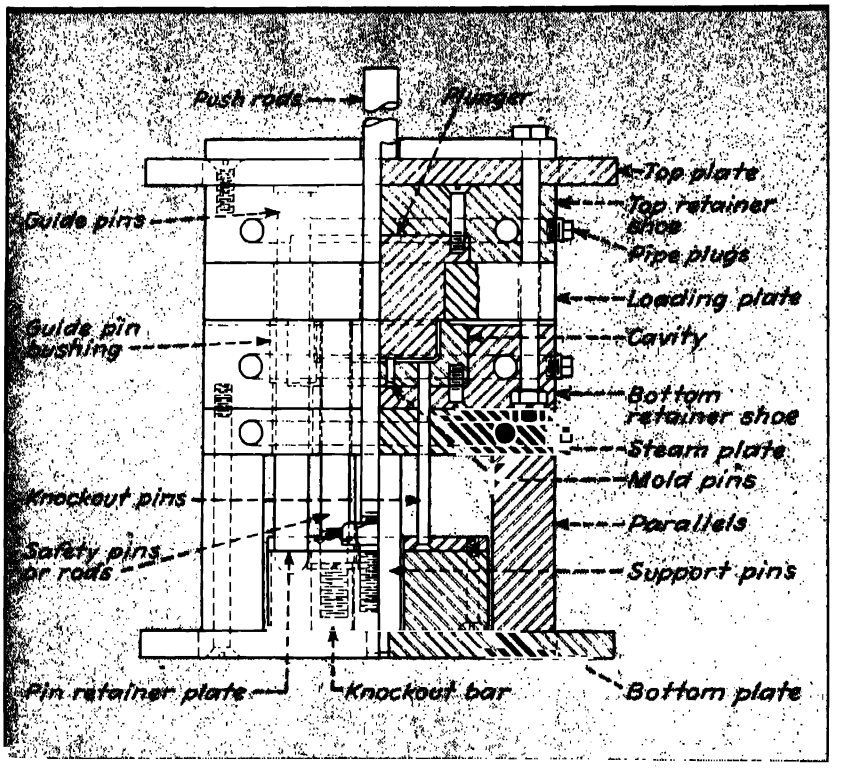


Fig. 2—In the loading shoe type mold the loading plate rests on bottom steam retainer shoe and the cavity. Push rods reset the knock-out bar

damage to knock-out pins and mold cavities by pushing the knock-out bar back into the molding position as the press closes. They should be large enough to withstand the mold closing pressure. Finally, all assembly screws must be of such size that they will withstand the stresses set up in opening or closing the mold.

Loading Plate Molds

In cases where the design of a mold cavity is such that an unusually large space is required for the molding compound, it is more economical to use a loading plate mold as shown in Fig. 2, than to machine this space in the cavity. The loading plate rests on top of the bottom steam retainer shoe and the cavity, but is carried with the top mold member when the press opens, thus permitting the use of shorter knock-out pins. Push rods are used to reset the knockout bar.

Guide pins must be long enough so that in closing they will pass through the loading plate and into the lower mold member before the plate comes in contact with the cavity. Loading plate molds must be so designed that when the mold is open there is room for the press operator to work both between the plate and the bottom of the plunger and between the plate and the top of the cavity. The plate itself should be long enough to accommodate push-down rods on each end.

Landed plunger molds, Fig. 3, are very little different from flash molds. Whereas, in a flash mold the cutoff occurs at the upper level of the bottom mold member, in a landed plunger mold this cut-off occurs at a pre-determined distance below the top of the cavity. Although some complications arise from excess molding material being trapped in the cavity, a passage can be provided to allow the excess to escape. However, it is sometimes best to design the mold without these passages and later provide the size found necessary by actual trial in sampling. The landed plunger mold is especially adapted to the molding of parts with thin sections since the line-up of mold members is very accurate.

What has been said in the preceding paragraphs concerning flash type molds and landed plunger molds can be said about straight plunger molds, Fig. 4, with the exception that in a straight plunger mold the plunger enters the cavity without resting on a land or horizontal cutoff. This construction causes full pressure to be exerted on the molding compound and results in greater densification of molded parts. It also results in varying wall-thicknesses, which may be objectionable.

Injection Molds

Thermoplastic molding compounds are most economically molded in injection molds like that in Fig. 5. Such materials generally require much higher pressures than do standard compression molding materials. The presses which are available for injection molding have such restricted spaces between strain rods that an entirely different technique must be em-

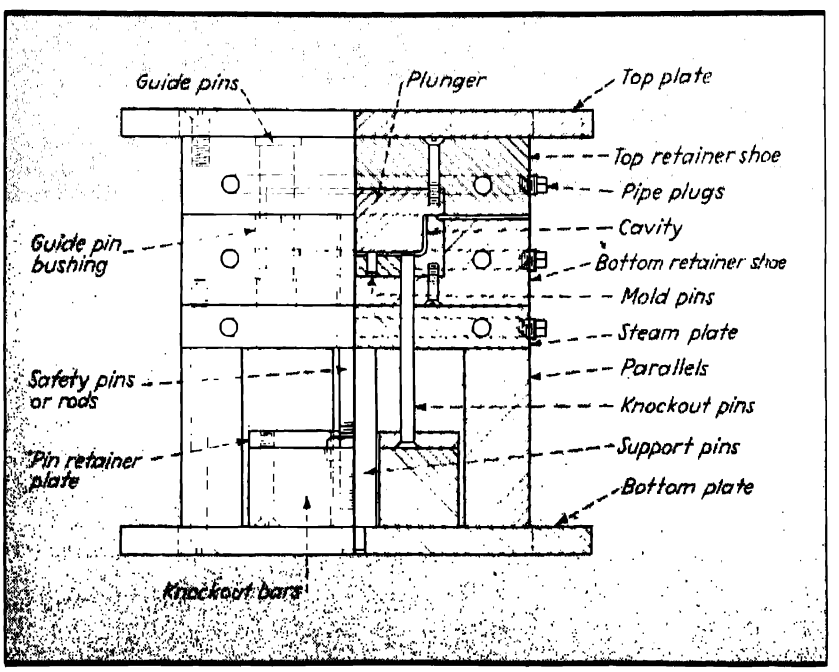


Fig. 3—Accuracy of alignment of mold members makes the landed plunger mold especially suitable for parts with very thin sections

ployed in design of the molds. Among the many items to be considered are proper support to withstand the higher pressures, the correct design and placement of sprues and gates, interlocks where line-up is important, and sufficient anchorage of movable mold members. In view of the extremely high pressure involved, it is especially important that the mold members should be properly lined up, and that the butting surfaces of the meeting members should be perfectly finished. Because of this close fit, it is necessary to provide means for venting the air that would otherwise be trapped in the mold when it is closed in the press.

Transfer Molds

Transfer molding is similar in many respects to injection molding, but differs in that transfer molding is applied to the injection of a heat-softened thermosetting material into a heated mold, whereas injection molding is applied to the injection of a heat softened thermoplastic material into a (normally) cold or chilled mold. Fig. 6 shows an example of a transfer mold with a transfer plunger entering transfer well and with limit stud. The advantages to be gained from the use of transfer molding are that cleaning costs on the molded parts are greatly reduced, more delicate inserts and pins may be used than would otherwise be possible, and closer tolerances on dimensions of the finished part can be met.

The molding compounds used in compression molding of plastics products have an abrasive action on the surfaces of the mold members. After a few hundred thousand parts have been molded in even the best of hardened steel molds, a perceptible amount of wear takes place. In order to reduce the wear of compounds and to lengthen the useful life of a mold it is well to apply a fairly heavy chromium plate (0.001 to 0.002 in. generally is considered sufficient) to all parts of the mold that come in contact with the compound.

An exception to this rule is the case in which it is desired that the molded parts either remain in the cavity or be extracted on the plunger when the mold is opened. In such cases, the molded part will remain on the mold member which is not plated. The advantages to be gained from the use of chromium plating are longer mold life because of greater hardness, greater abrasive resistance and greater corrosion or staining resistance, and decreased manufacturing cost of molded parts because the lower coefficient of friction allows easier extraction. The length of time required to "break in" a mold has been cut down by chromium plating from about two weeks to two or three hours. Worn mold members can be built up to the proper dimensions by chromium plating and will then usually outlast the original unplated mold.

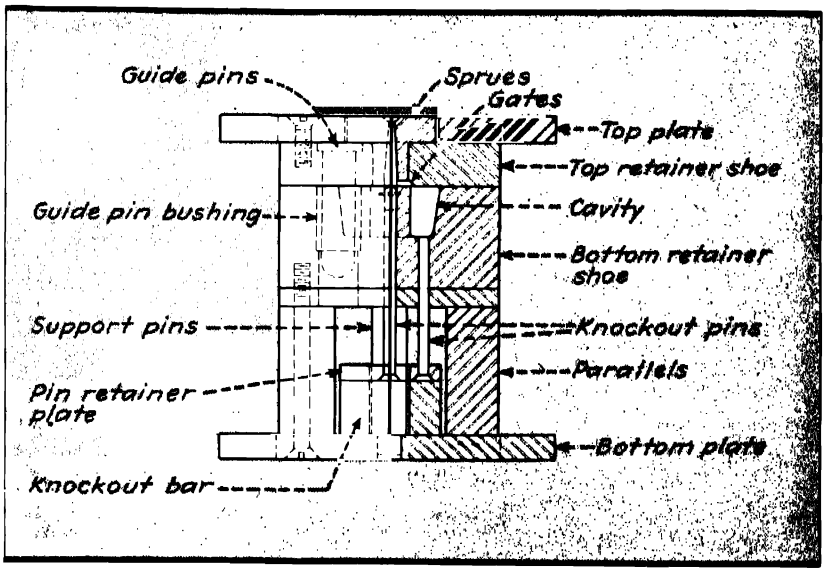


Fig. 5—Because of the high pressures used, it is important that members of injection molding dies be perfectly finished and aligned

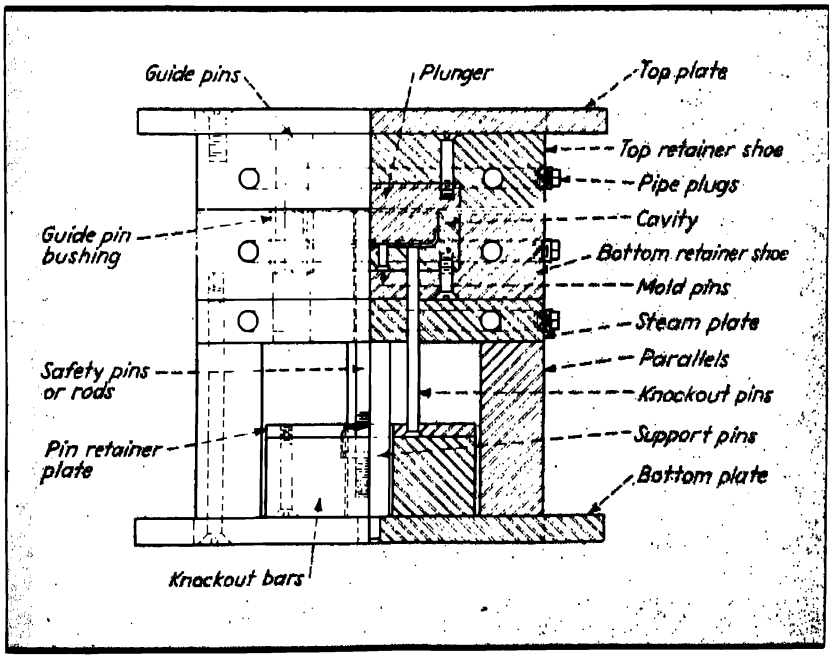


Fig. 4—In a straight plunger mold the ram exerts full pressure on the moulding compound, resulting in greater density in the product

Design Considerations

In the design of any of the previously mentioned molds, a number of items must be kept constantly in mind by the designer. The type of molding material must be known, since any two or more materials which might be used might require different molding pressures and temperatures. These materials might require different shrinkage allowances to compensate for the decrease in size of the molded part when it is extracted from the mold.

The designer must know whether the molding material will be in bulk form or whether it will be compressed into a preform. The form of the molding material determines the loading space required. The location

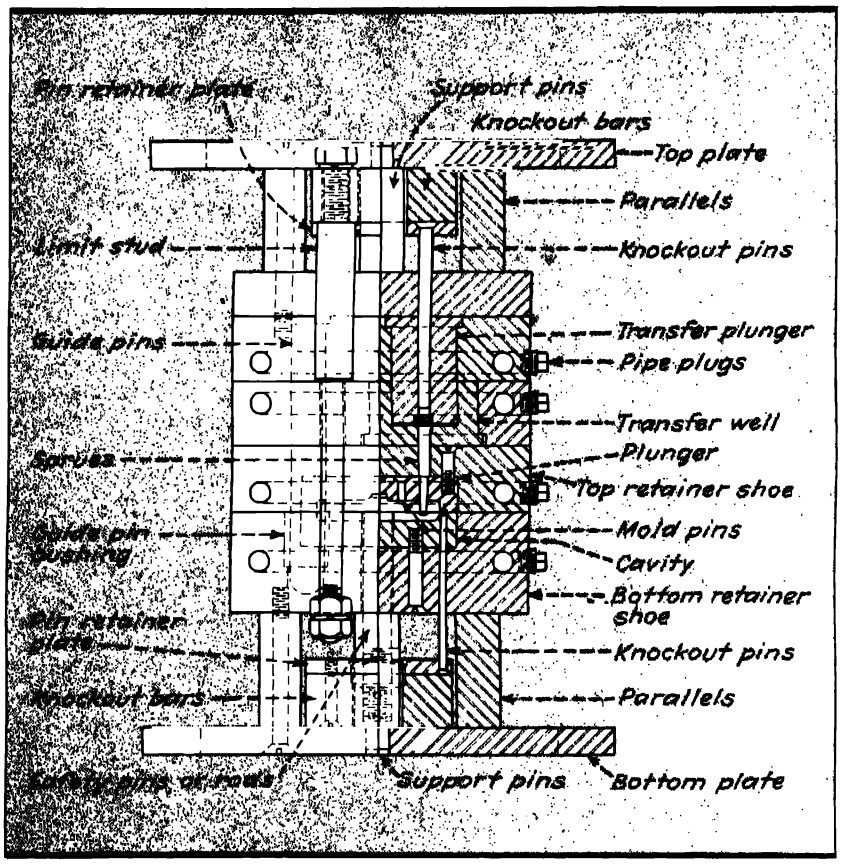


Fig. 6—Cleaning costs are low for plastic parts produced in transfer-type molds which inject heat-softened material into a heated mold

and the size of guide pins are based on the mold size and construction. As mentioned above, heating channels should be formed around the cavity and plunger and beneath the cavity. In all cases where the cavity is machined out of the same block as the steam retainer shoe, ample distance (at least $\frac{5}{8}$ in.) should be allowed between the cavity walls and the heating channels. The design should be studied to determine the proper location for knockout pins. These pins should be ample in size and in number, in order to assure proper ejection of the molded part with little or no pin maintenance.

Mold pins, or projections in the mold which form holes in the molded part, should be checked for proper proportions. It is important that the lengths of slender pins do not exceed twice their diameter. Draft or tapered sides should be used where allowed by the design and in the largest amounts possible, in order to facilitate extraction of the molded part. The necessity for and the location of pull pins and wedges must be determined. The desirability of making a mold member in sections or in one piece must be decided. Whatever else is done, designs should be checked to be sure that it is possible to make the mold parts.

Another item for the designer's consideration is the steel to be used for the various mold parts. Past experience has gone far toward narrowing the field of suitable materials. Today there are only a few special steels which are being used. For hobbed mold cavities, a special grade of carbon-chrome-silicon steel is required for the hard, tough master or hob that is pushed into the equally special SAE 3110 hobbing steel.

SAE 3312 steel is used for machined parts of molds, both compression and injection. This steel, as well as the SAE 3110 hobbing steel, must be case-hardened after the parts have been finished to their final form in order to provide the necessary surface-hardness and strength. In the case-hardening furnace a case of 0.040 to 0.050 in. is applied to the mold parts and to test pieces which subsequently will be broken to check depth. Small mold pins are made of music wire, while larger pins are made of drill rod.

It should be noted that the SAE numbers given above are merely indications of the basic formulations of the steel used for molds. The steel manufacturers have done considerable work on improving the processing of these special steels and, as a result, the toolmaker has been given materials with better machinability, greater strength, better hardening properties, and more freedom from inclusions. Our plastics department employs a metallurgist who spends his time trying to find materials and methods for molds.

Molds are an indispensable part of the plastics industry. Such molds, if poorly designed, can be a source of endless annoyance and loss to the molder. Properly designed molds will give high production over a long service life. A good background of practical experience in all of the phases of the plastics molding business is one of the greatest assets of a mold designer.

Limiting Age of Trainees

MANY SHOP TRAINING courses limit the minimum age of applicants to 21 years. In some cases it is younger, frequently 18. In view of the shortage of trained men and the likelihood of greater demand, it might be wise to modify some of our ideas on this subject.

There may be cases where men over 21 can afford to start work at apprentice wages. If they can—and want to—it is difficult to see why they should not have an apportunity to become skilled mechanics.

Shops which maintain training courses for operators, or for men to become skilled in the operation of one or more special machines, do not find age a barrier. "Old dogs can learn new tricks," and many become skilled in one or more lines. They usually have a greater feeling of responsibility, because of age and previous experience, than very young men.

A case in mind is a young man of 34 who has worked in machine shops and apparently has decided mechanical leanings. He wants to be a thorough all 'round machinist but is barred from all apprentice training courses that he has contacted so far. He is willing to start at apprentice rates of pay, and would probably learn much more rapidly than the average apprentice because of his shop experience. The chances are that he would be a first class machinist of value to almost any shop.

Helping schools help industry



Head boy ... is at the Sidney High School on equipment donated by a local company. The first results of the enlargement in a manufacturing shop are thus evident

BY WENDELL W. WHIPP PRESIDENT MONARCH MACHINE TOOL COMPANY

Industrial training must be brought down to earth if it is to be effective. The sooner we start thinking in terms of local needs, the sooner will Shop X in Town Y get results

INDUSTRY needs more trained men. Except in the very depths of depression there never have been enough properly trained men in American industry to meet current needs. Whenever business has emerged from a slump and started uphill there has always been a scramble to secure such trained men as were available. Only when the supply became smaller than the demand has business set seriously about training new ones.

A few industries have developed thorough apprenticeship training and learners training programs. But apprenticeship programs account for only a small percentage of the total number of men to be trained and are designed chiefly for men expected later to arrive at supervisory positions. Learners programs as put into practice are often admittedly short term limited efforts designed to meet an immediate emergency.

There has been a hope that some sort of a cooperative plan or organization might be set up and operated by the industries within a community for the training of men for industrial occupations. But to all intents and purposes this is a theory.

When vocational education began to develop some years ago there was a tendency upon the part of a good many industrialists to feel that the schools could largely take over the job of training men. While schools did prove of immense value in providing young men with groundwork for industrial jobs it was soon learned that no amount of education could take the place of actual training in the shop.

By and large this whole picture falls into no particular pattern. It is simply a general hodgepodge. There has not been developed any major formula any one broad practical method, for training men.

What does this mean? Does it mean that in this particular field industry has fallen down? Does it mean that the schools have fallen down? I don't think so for a minute.

I think that the schools have been doing a marvelous job considering the rather passive attitude which industry has shown toward them. They have in fact gone about the job in the only practical way in which it can be done: by the companies in each community tackling their training problems in the light of their own particular circumstances.

The kaleidoscope which today's training picture presents is to my mind proof positive that the training of men is not a blanket proposition. It is something which companies and communities can and must undertake on the basis of their own needs and facilities.

The moment the subject is approached from this point of view it ceases to become a complicated national problem. It becomes instead a specific local problem sufficiently definite and concrete to be capable of solution.

For instance. Mr. Jones president

of the ABC Company, might be able to contribute little to a national symposium upon the subject of employee training. But as to his own plant, he knows that right now he needs seventeen machinists. He would like to have at least six boys starting in his plant each year on an apprenticeship training basis; and he wishes that the young fellows applying for jobs had a little more practical knowledge about his particular business and the kind of machines which they are expected to operate.

That is much the situation which confronted the industries of our small town of Sidney, Ohio, and we have worked out what for us at least has been a practical solution.

In the first place, we felt that we would not have to go outside of Sidney for our new men even in view of a substantial expansion in business. This meant that we would probably take into our employ every year a number of the boys from Sidney schools.

Obviously each company could work out for itself, in whatever way seemed most practical for its own requirements, apprentice training courses or learners' or other training programs for the boys to tackle as soon as they got into the shop. The factor which worried us was the educational one.

Our boys, particularly our high school graduates in Sidney, had just as good a vocational education as graduates of similar schools in other cities but they didn't know enough about Sidney industries, and about the machines to be operated in Sidney plants.

Equipment Supplied Gratis

It seemed to us that our high school might be interested in having facilities which would enable them to teach the boys at least some of the rudimentary principles of the kind of work which is done in the various factories in Sidney. From that point on, it was simply a matter of working out details.

Under the Smith-Hughes law, the schools could obtain from the federal and state governments a grant of half of the salaries of teachers needed for vocational training. The stumbling block in the past had been the cost of equipment, the cost of supplies and materials, and the cost of power and maintenance.

The industries of Sidney agreed to supply the machines and materials. Lathes, drill presses, planers, shapers, metal-melting furnaces, heat-treating furnaces, hand tools for the machinist trade, steel bars, sheets, bolts and screws were contributed. The increased expense to the school system, therefore, was confined largely to the cost of power and maintenance.

In most communities, school training courses comparable to those in Sidney would be absolutely impossible without the cooperation of the industries of the community. The school simply could not afford to pay for the equipment and materials required. Where this is attempted by school funds alone, it often happens that equipment is so limited and materials so few and inferior that the "training" is little better than theory and provides no real preparation for actual shop practice.

Boys Get Advance Training

As to results this is what the Sidney High School training program means to our own company. Because the boys who come to us from our high school have already operated machine tools and learned something about them, our company in our training program, can skip right over those first few days or weeks of complete bewilderment which are inevitable and which have to be paid for when boys come into a plant without any previous familairity with the type of machine used in that plant. In short, those boys can go to work immediately on a productive basis.

The school authorities in Sidney are just as pleased as are Sidney's industries with the co-operative plan which we have in effect.

It not only gives them equipment and tools to go with – it enables them to do a really vocational job. It helps them to give their boys the kind of training which is keyed into the employment needs of their own city.

Why can't an arrangement like this one be extended, at least experimentally, to hundreds of other communities?

This plan is founded upon two very simple premises- the school fits its training courses to the industries in its own community, and the industries in the community provide the school with proper training equipment and materials.

Note that this sort of cooperative arrangement is not one designed to help merely the apprentice training men – the small percentage who are chosen as candidates for future supervisory positions. This program follows the broad principle of educating the young men in a community to be able to take their places in the industries which support that community.

Naturally a method of this sort is much simpler in a city which has one major industry than in a city which has a variety of industries. It is simpler perhaps in a small town than it is in a large city. And yet it is not impossible in a large city.

In Denver, Colorado, there is operated, as a part of the city's regular school system, the Emily Griffith Opportunity School. This vocational school is open not only to high school students but to adults, and the courses given and number of pupils having them are coordinated with the industries and the employment opportunities in Denver.

Williamsport, Pa.- a city of about 50,000 has organized a school to train adult workers to fill the particular requirements of local industries. This is a community enterprise—cooperating agencies include the Y.M.C.A., the Y.W.C.A., the N.Y.A., the W.P.A., the local trade association, the Catholic parochial schools, the county school system, the local Civil Service Boards, and the various industries having plants in Williamsport. It was recently reported that about 3,000 people are enrolled in this school and last year some 600 of the "pupils" got jobs in Williamsport's industries.

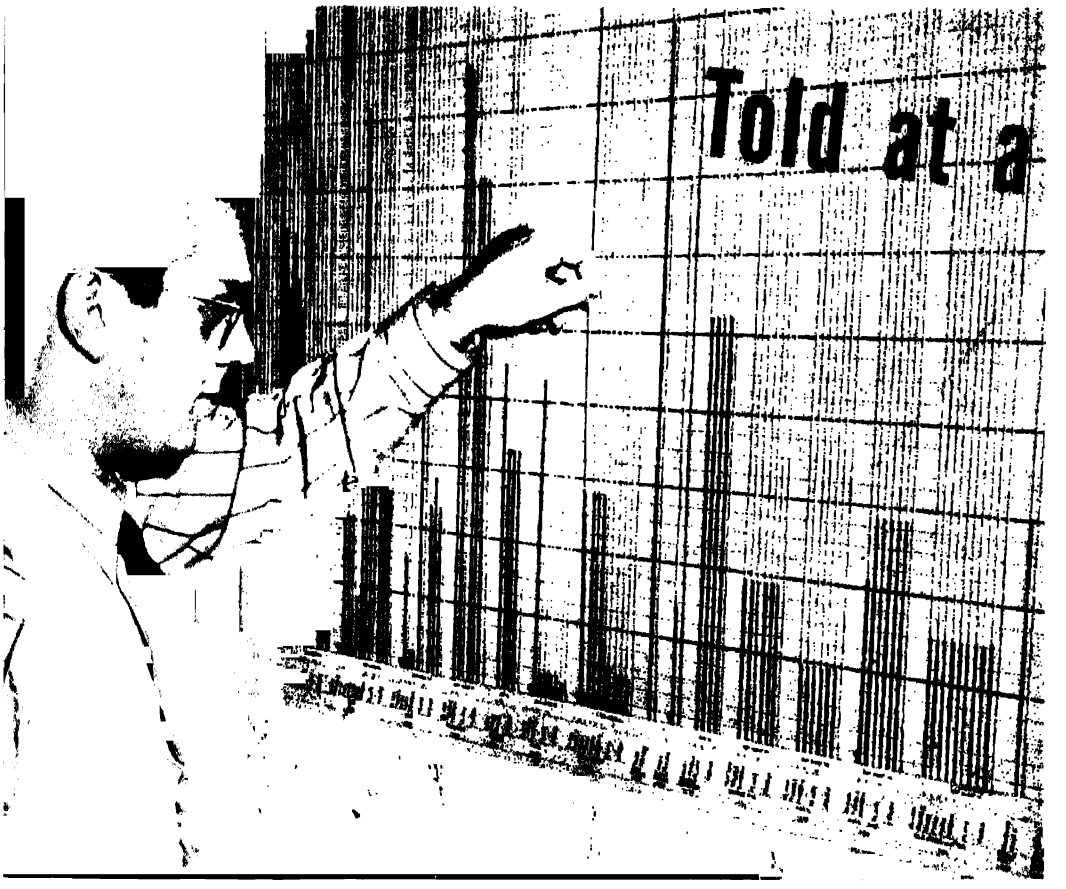
If for some reason a community enterprise is not practicable, it seems to me that the individual company would do well to try to work out with school officials some method whereby, if the company would provide machines, equipment and supplies for training purposes, preliminary training would be taught by the use of that equipment. The result would be a potential supply of youngsters who would be, to say the least, three or four weeks ahead of other applicants.

Misfits Eliminated

One of the most important functions which the presence of actual equipment in school training courses accomplishes is that of helping to weed out the misfits. Many a boy who thinks he would like to be a machine tool operator may change his mind after actually attempting to operate a machine tool. Every employer knows how costly this weeding out process is when it has to be done after high school boys have come into the plant.

Thus, our schools can be of enormous help to us if they have the right equipment. The machines do not have to be the latest or best models. Basic principles of machine operation can be taught on a machine still capable of fair work but too old for today's rigid requirements.

Told at a glance



Quick adjustment of a colored string to correspond with work done keeps this control chart up-to-date. The status of any batch of parts, whether inside the plant or at an outside shop, is revealed at a glance

KEEPING TRACK of thousands of small parts as they progress through various shop operations is a problem often solved by complicated, cumbersome systems which often seem more trouble than they're worth. Speed Products Co., paper fastening equipment maker, has worked out a solution which combines simplicity, economy, convenience and speed.

Devised by S. A. Crosby, chief engineer, it consists of a unique adaptation of the commonly used flow-chart principle, in the form of a bar-chart control board in which the bars are lengths of colored cord readily adjusted to keep pace with production.

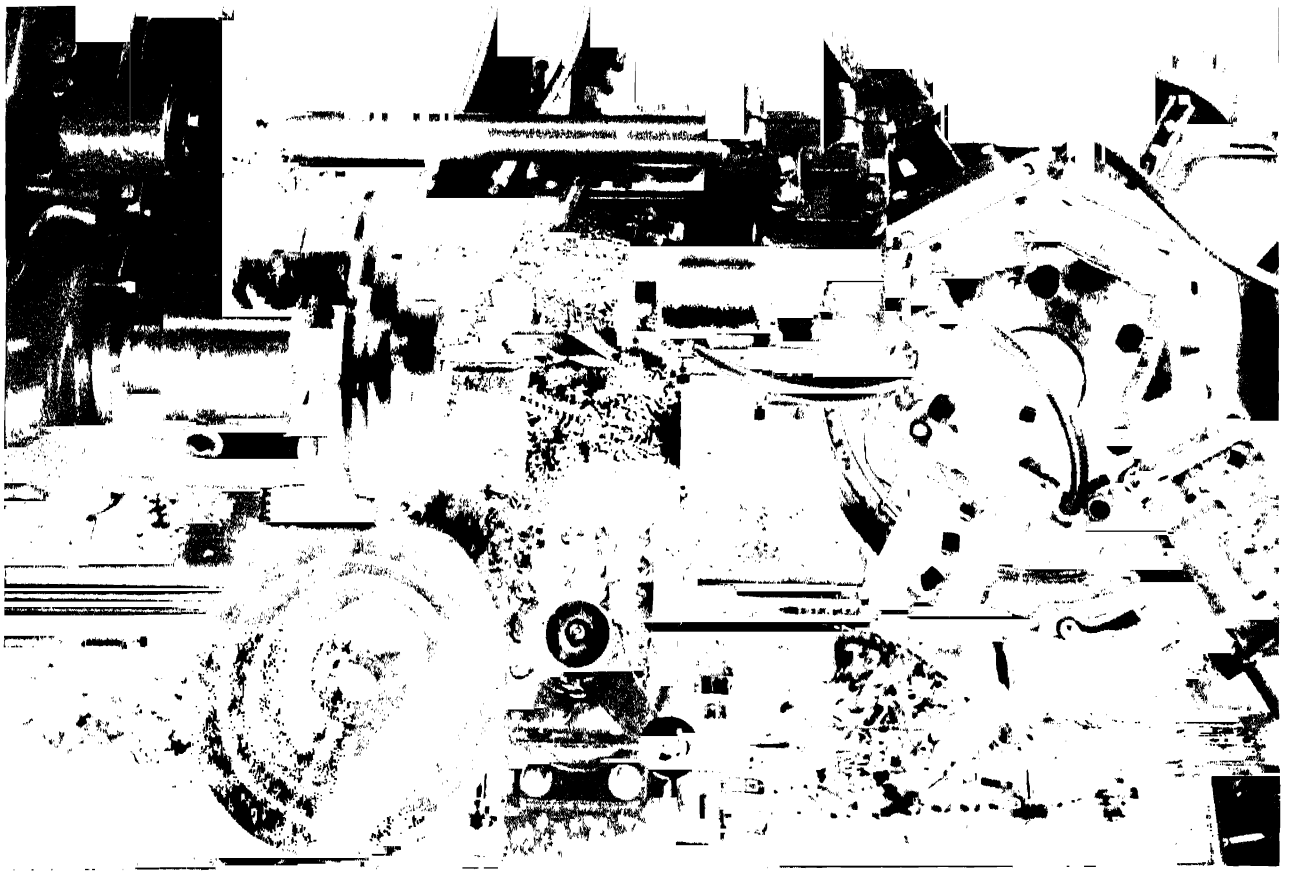
The board itself is constructed of a plywood backing onto which are glued sheets of drawing paper. Along the top and bottom edges of the plywood are nailed half-round wood moldings having a diameter somewhat greater than the thickness of the plywood. Over these moldings pass vertical loops of waxed string, properly spaced by nails driven into the moldings. Each loop is made of two lengths of cord, one white and the other colored, tied tightly enough to hold the loop snugly on the moldings at the top and bottom.

The chart proper is laid out with its vertical scale representing number of parts, heavy horizontal lines being ruled for every 10,000 units, with lighter lines in between. The base is composed of sections for the individual parts, each section being divided into columns for every operation required by that particular piece. For parts purchased ready for use from outside suppliers, there are columns marked "received" and "issued." In the case of parts sent outside for hardening or finishing, there are also columns marked "out" and "in." In each case there is a column marked "issued." Every column has its corresponding string.

When production starts, all strings are set so that the joint between the white and colored portions comes at the bottom, or zero line, leaving only white string showing. At the end of the first day's production, each string is raised so that its colored portion indicates the number of parts which have passed through the operation it represents. Day after day the same procedure is followed, the colored string climbing like mercury in a thermometer. When one operation is completed on the total number of parts in the lot, the colored string is raised to the top of the chart, showing that this operation is finished and that the parts are ready for the next operation, which is similarly indicated. Thus at any time a glance at the chart shows the exact status of any batch of parts.

When all operations on a given part are completed, the chart so indicates and the parts are sent to a stock room. If they are sent outside for further operations, the "out" column shows exactly how many have been sent and the "in" how many have been returned. When a sufficient number of each part required is in stock and assembly is to begin, the necessary requisitions are issued and the number of parts issued by the stock room to the assembly department is indicated in the "issued" column of the board.

Posting can be made as often as desired from tickets filed by the foreman or stock clerk. Foremen, superintendent and others can consult the chart as a guide to what has been accomplished and to what should be scheduled to bring low parts up to the level required to keep machines busy and production moving in step with assembly. The chart also keeps purchasing, production and stock departments informed and enables them to plan their work in a systematic manner, and permits management to follow progress of work through the plant and see that assembled units will be ready to meet delivery date.



Widely different diameters are machined simultaneously by using carbide tipped tools on the larger diameters and high speed steel tools on the smaller diameters. Two diameters are turned while the hole is drilled

What tools for turning?

BY D. W. MELLOR, JONES & LAMSON MACHINE COMPANY

High-speed steels and sintered carbides each have their place in turning, boring and facing operations. They often can be used together advantageously

All of the factors involved in a particular metal cutting operation are interdependent. The choice of cutting tools is only a part of the equation for which the solution is the most profitable way to perform a certain operation on a certain part. So much has been written about the relative merits of various cutting tool materials that in many cases the main issue has been lost in the controversy and the cart planted solidly in front of the horse. This is particularly true with turret and single spindle automatic lathe operations.

Hard alloy cutting tools and high speed steel cutting tools each have their place and it is not difficult to extol the merits of one or the other in specific cases. To make a comparison on general terms is both dangerous and misleading. The efficiency of these materials is dependent upon the use to which they are put and perhaps most of all upon the machine in which they are used. This machine must be capable of using the cutting materials to their maximum advantage, it must be capable of giving the hard surface speeds required and it must be able to transmit the power for cuts taken at these speeds without sacrificing accuracy.

For many years we have experimented with hard alloy cutting tools in fact we first worked with them back in 1926 when some early specimens of these tools were brought over to us from Europe. Today we machine some 1,800 small lot jobs using hard alloy cutting tools. Many more such jobs could be machined in the same manner but other methods are employed to reduce cutting time on these jobs. It is hardly necessary to use special tools on a turret lathe to save ten or fifteen minutes on a shaft or spindle that can be machined in three minutes with multiple tooling on an automatic lathe.

Naturally the quantity must be sufficient to warrant the use of an automatic lathe but there are numerous instances where lots of spindles as small as five or ten machined on automatic lathes with high speed steel tools show a saving of 30 per cent or more over the same operation on a turret lathe. Multiple tooling does not necessarily require the use of an automatic lathe. Turret lathes equipped with a bridge type carriage and cross slide provide opportunities for multiple tooling and

combined cuts which may reduce cutting time 75 per cent or more

Logically then where work can be performed on either automatic lathes or turret lathes, the first consideration is the choice of the machine This generally is a simple comparison of the total estimated lot production time

The question of tooling then arises This is a more complex problem involving several factors First perhaps is the relation of cutting time to total lot production time since the choice of cutting tools affects cutting time only Shall hard alloy tools be used or will multiple tooling or combined cuts or both with high speed steel cutting tools serve as well or better?

In some cases cutting time is almost eliminated as a factor in the choice of tools by the nature of the material being machined In cases such as the machining of cast iron brass bronze aluminum and similar materials where the abrasive qualities of the material make tool life a predominant factor hard alloy tools are unquestionably superior On small lots they can be stored and used again with just a little touching up and on large lots tool grinding is reduced to a minimum On most steel jobs however cutting time is a primary factor and generally will decide the kind of tooling and the type of tools to be used

Many of the turret lathes in our plant are of an older type that have served their purpose well However with the advent of fast cutting hard alloy tools and with the demand for faster more accurate production a more versatile machine was needed Accordingly during the past few years we have revolutionized our turret lathe design We have provided a wider range of spindle speeds improved the rigidity of the machines and improved the ease of handling In order to make a thorough test of these new lathes under production conditions we inaugurated a special turret lathe department to do general lathe work This department now is an important and profitable factor in our production

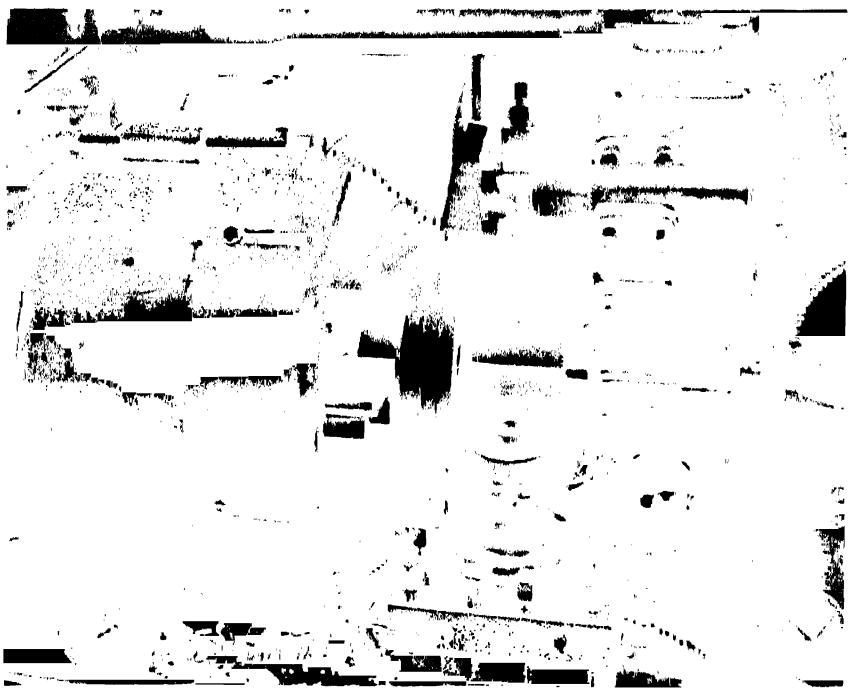
All types of parts from small lots of studs pins and screws that could not be machined economically on automatics to parts made from castings or forgings weighing 60 lb or more, are machined in this department High speed steel and hard alloy cutting tools are used to advantage after a careful study of their possible application and the alternatives in each case has been made

Sometimes it has been found that by multiple tooling on the front and rear of the cross slide as many as nine tools have been mounted this way, cutting time has been reduced to a relatively negligible item and high speed steel tools are adequate for the job Obviously if a very small lot is to be machined, a simple, quick set up with hard alloy cutting tools is more advantageous Again when very close limits are to be held and the cut must be interrupted frequently to gage the work carbide tipped tools cannot be used to advantage On thin or fragile work distortion due to heat or to pressure of chuck jaws may require extra gaging or extra handling time which will still further reduce the relative importance of cutting time or make high surface speeds impractical

Fast cutting hard alloy tools have been used to great advantage They may be used exclusively on a single job or in combination with high speed steel tools Their use with high speed steel tools does not appear to have had the attention that their exclusive use has received

For example in many cases, it would not be practical to combine cuts on different diameters if high speed steel tools were used alone The lower spindle speed required by the larger diameter would entail longer cutting time than if the two diameters were machined separately But with a carbide tipped tool to machine the larger diameter and a high speed steel tool to machine the smaller, maximum surface speeds can be run on the smaller diameter without increasing the surface speeds on the other diameters beyond the capacity of the carbide tipped tools

Materials such as cast iron bronze brass aluminum and other nonferrous metals because of their abrasive effect on high speed steel cutting tools make the use of hard alloy cutting tools obligatory if the maximum surface speed allowed by these materials is used The machine must be capable of using these tools, high spindle speeds rigidity and power transmission far in excess of those required when high speed steel tools are used, must be available to use hard alloy cutting tools to their maximum advantage when cutting metals



Frequently tools at the front and the rear of the cross slide can be used while tools mounted on the hexagon turret are cutting In this operation a tool mounted on the rear of the cross slide faces while two tools in a multiple turning head of the turret bore and turn

Tool life in general is another important factor in the selection of cutting tools This factor is very difficult to gage Much depends upon the operator and much upon the nature of the job and the material Under certain conditions, hard alloy tools need less service per pound of metal removed than do high speed steel tools Each case merits individual study In the final analysis method, machine and tools combine to achieve economy of operation not the tools alone

Fabricating the flying fortress

Huge steel jigs make possible mass-output economies for the limited lots of subassemblies in the world's best bomber

MORE ENCOMIUMS have been heaped upon the broad wings of Boeing's Flying Fortress than on any other American military plane. Praised publicly as the world's safest airplane, it has also been widely heralded as the deadliest weapon in the history of warfare. It has set astonishing speed records across the North American continent, and has won heart warming ovations during good-will flights to South America. Substantial new orders for the ship have caused redoubled activity in Boeing Aircraft Company's Seattle plant where production has been stepped up to one plane every four days.

Making the Flying Fortresses involves problems rare in other branches of the metal working industry, problems only recently solved by aircraft production experts themselves. One of the most trying is the handling of unwieldy delicate subassemblies, which must be kept in precise alignment until each has become an integral part of the plane structure. Outstanding among these units are the various wing sections and the fuselage. These are assembled in huge jigs made of structural steel shapes welded together to form rigid frames. Built into each jig is an elaborate network of scaffolding to enable workmen to work on several levels at the same time.

Handling the completed assemblies in the crowded plant is a problem all its own. The units are large and cumbersome, and obviously can't be banged around like locomotive castings. Fortunately, their weight is comparatively slight and an ingenious overhead monorail system has proved to be highly satisfactory. In this system the crane trolley including the operator's cage, moves the width of the bay hanging from two rails, the rail structure in turn being free to run the length of the bay, suspended by half a dozen rails fastened to the roof trusses. Thus any spot within the bay may be serviced, without sacrificing valuable headroom and without building heavy structural work, which would be necessary to provide for a crane span of almost 200 ft.



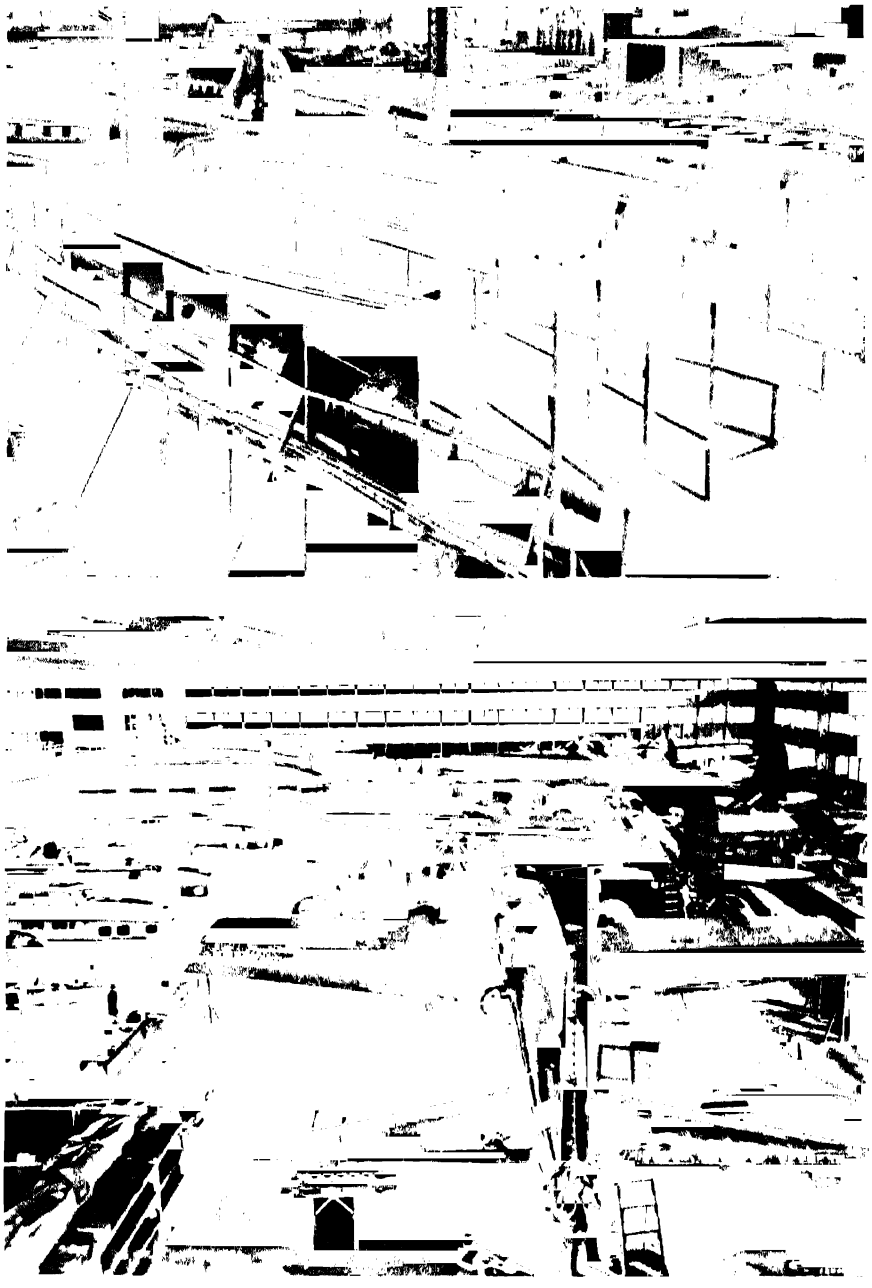
Wing sections are assembled on edge in huge welded-steel jigs (top). Permanent scaffolding enables men to work on several levels of both sides at once. Special fixtures facilitate handling by a monorail crane hanging from roof trusses. Below, landing gear is installed as sections progress down the bay.

THE SHIP ITSELF

The Flying Fortress is a high-flying, fast moving, long range weapon claimed to be capable of reaching out to any conceivable enemy base, of carrying enough explosives to cripple any ship afloat or wreck any type of ground fort or gun emplacement, and of defending itself successfully against attack launched by current pursuit ships

It has injected a new element into the field of aerial warfare, and has bred a whole new category of military aircraft Though its general design is not unlike that of earlier ships, its merit lies in an all-round stepping up of practically all the characteristics of a military plane greater size, greater speed, greater range, greater load-carrying ability greater high altitude performance, greater ability to defend itself

Powered with four 1,000 hp air cooled radial engines, the Flying Fortress is an all-metal mid wing monoplane with fully retractable landing gear Turrets are provided around the fuselage at the sides top and bottom, so that machine guns can be trained on a ship attacking from almost any direction It has a wing spread of 103 ft 9 in , a length of 67 ft 10 in , and a gross weight of 45 170 lb Its service ceiling (altitude at which rate of climb has fallen to 100 ft per min) with full load is 30 000 ft considerably above the effective range of anti aircraft guns Its top speed is 268 m p h Models now under construction are expected materially to exceed these performance figures



Surrounded by wood scaffolding the steel jigs shown above insure accuracy in fuselage assembly As each fuselage nears completion it is carried to the final assembly line where wings tail surfaces and other subassemblies are fitted in position All production lines for subassemblies feed into this assembly bay Below finishing touches are applied Production is one complete plane every four days



Bombs by the ton can be released when the bomb bays of the substratosphere Boeing Flying Fortress are swung open

More about stripping

BY JOSEPH I. KARASH, RELIANCE ELECTRIC & ENGINEERING COMPANY

When should knock-out pins be used? What designs permit the punch and stripper to be ground at the same time? The author gives practical hints on these and other design points

KNOCK-OUT PINS provide a method of stripping which has advantages from the standpoint of low die maintenance cost. Shown in Fig. 11 is an example of knock-out pin stripping which has a number of applications. The die is shown in both the open and shut positions so that the action of the pins can be better visualized. It should be noted that on the down-stroke of the ram, the stripper plate is in a retracted position. As the punch pierces the material, the blank is forced down through the die block and the outer piece is forced up onto the punch. Near the top of the upstroke the knockout pins come in contact with the stationary knock-out bar. As the ram continues to rise, the pins force the stripper plate down and thus strip the work from the punch.

Since the material is stripped at the top of the ram stroke, this type of die should be used only when the material is to be punched but once. Should an attempt be made to use this die for punching a series of blanks from strip stock, the scrap would travel up to the top of the ram stroke and make the handling of the material an extremely awkward operation.

Stripping the material from the top of the ram stroke is not always a disadvantage. On the contrary, it can be made to be an asset if the die set is used in an inclined punch press. The tilt of the press will cause the material stripped at the top of the ram stroke to fall clear of the die, thus saving the operator the necessity of placing his hands into the die set to remove the scrap.

Fig. 12 shows a design of punch holder identical to that shown in Figs. 9 and 10 (*AM*—Vol. 84, page 466) except that a hole has been drilled through the shank for a knock-out pin. This makes the die flexible in the sense that the pin stripping action can be used for unit stock inclinable press operation, or spring or rubber strippers can be inserted so that the die can be used for punching a series of blanks in strip stock. When using the knock-out pins, the material automatically would be ejected from the inclinable press. When using an inserted spring or rubber stripper, the material would be left lying on the face of the die block.

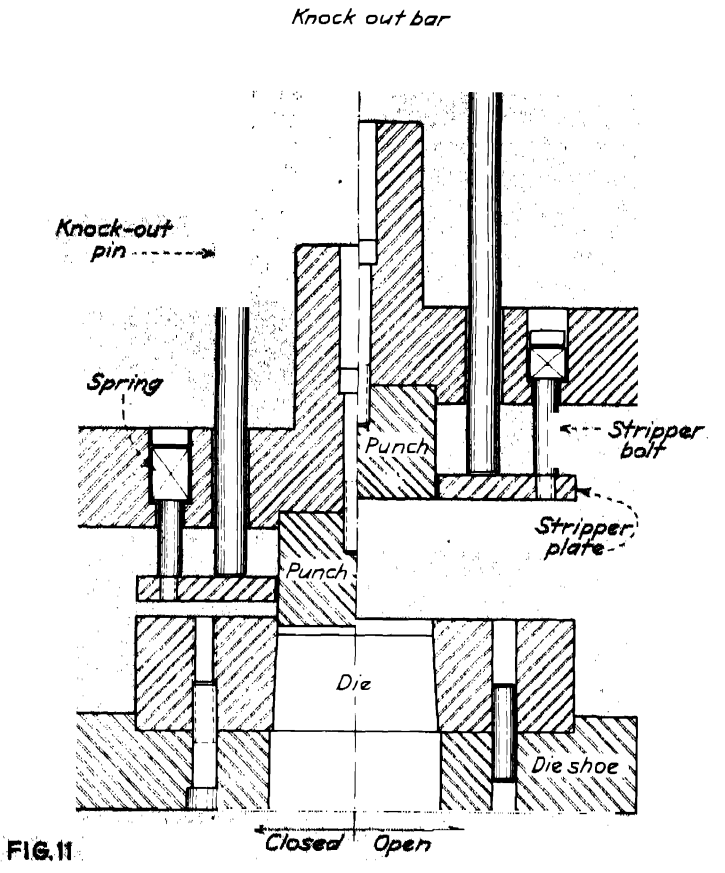


Fig. 11—Knock-out pins have definite advantages from the stand-point of die maintenance cost, and are particularly useful for single punchings made in inclinable presses

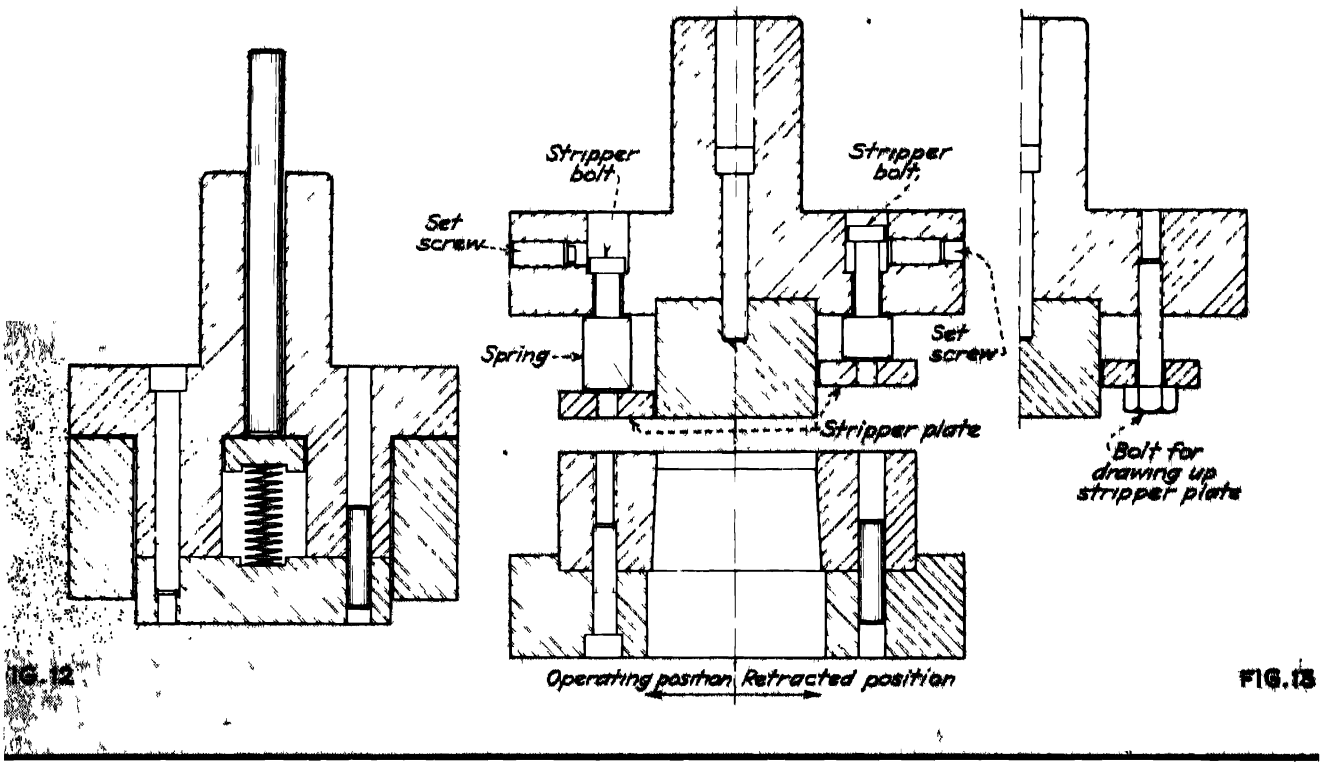


Fig. 12—This punch holder is drilled for a knock out pin, making a flexible arrangement which can be used for unit operation in an inclinable press or with a spring for punching a series of blanks. Fig. 13. Set screws are used to hold the stripper plate in a retracted position so that punch and die can be engaged for setting up in the punch press without guide posts.

The inherent advantages of the use of knock out pins from a die maintenance viewpoint are:

1. No dismantling, reassembly or adjustment of the stripping mechanism is required in conjunction with the grinding operation due to the fact that the stripper plate normally is in a retracted position.

2. Knock out pins do not prevent the punch from entering the die and consequently do not in themselves necessitate guide posts for setting up.

Stripper Plate Locking

In designing dies it sometimes is desirable to produce a spring operated stripper plate die which can be set up without guide posts. A simple method of accomplishing this is shown in Fig. 13. The design is a spring operated stripper plate type except that tapped holes are provided in the punch holder so that the heads of the dog point set screws can be entered under the stripper bolts in order to lock the plate in a retracted position. At *A* in Fig. 13 is shown the provision for forcing back the stripper plate to allow the set screw to get under the stripper bolt heads. With the stripper plate in a retracted position the punch and die can be engaged and the die set set up without guide posts.

After the die set has been secured into position in the press the ram adjustment screw is run down until the die has been compressed enough to take the stripper bolt heads off the dog point screws. The set screws then can be backed away to clear the stripper bolts. The ram adjustment screw is then raised and the die set is in operating position.

Before removing the set from the press the set screws can be locked into place again by compressing the stripper plate with the ram adjustment screw. The die set can then be stored with the stripper plate in a retracted position. One of the elements of die maintenance cost which can be affected by design is the labor involved in the sharpening operation. This labor element usually is the greatest in the cases where the stripping mechanism must be dismantled, reassembled and adjusted to compensate for wear every time the die is ground. Should the die be so designed that it is unnecessary ever to dismantle or adjust the stripping mechanism it readily can be seen that savings will have been achieved in die maintenance.

A design principal which can be used to accomplish this objective is to construct the die set so that both the stripper and the punch can be ground down during the sharpening operation. This always will keep the stripper flush with the cutting edge of the punch thus eliminating all dismantling and adjustment during the life of the die.

An example of this type of design is shown in Fig. 14. The stripping is accomplished by a sleeve backed up by stripper springs. Both the sleeve and the punch have shoulders machined on them to act as stops. Length from the shoulder to the end of the sleeve should be held to a maximum dimension so that the life of the punch will not be limited by the stripping device.

Since the edge of the stripper is flush with the end of the punch the stripper springs must be preloaded. This is accomplished during the original assembly operation by the screw which secures the punch.

Guide posts should be used in conjunction with a design of this type to facilitate setting up. If no guide posts are used the set up will be difficult because the stripper prevents the punch and die from engaging. A

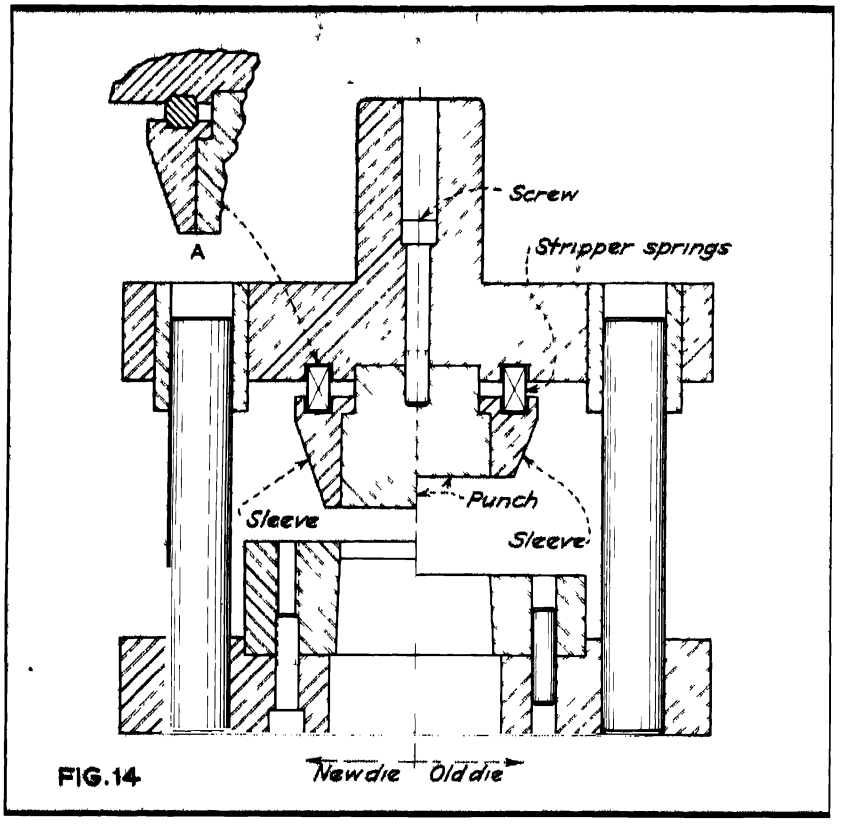


FIG. 14

Fig 11 Dismantling and readjustment of punch and stripper plate is accomplished by designing them so that both may be ground at the same time

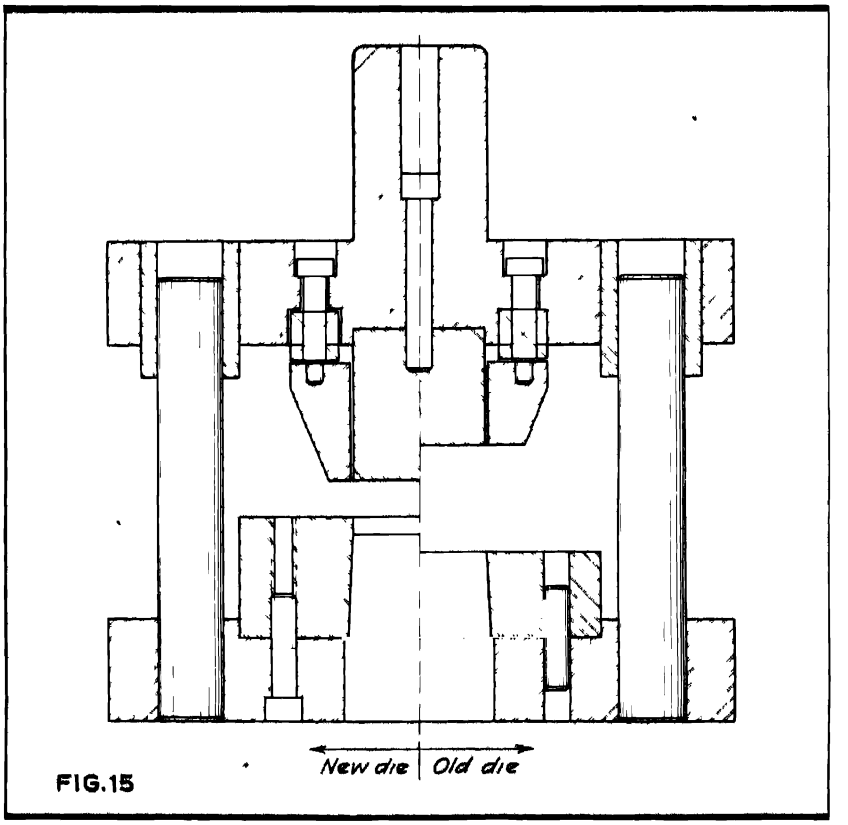


FIG. 15

Fig 15—This design combines the advantages of simultaneous grinding of punch and stripper with the possibility of dismantling the stripper without removing the punch

similar form of piercing die is shown at *A* in Fig 14, except that rubber is used instead of springs to provide the stripping force

Support with Bolts

Another example of design in which the stripper and the punch are to be ground simultaneously is shown in Fig 15 Instead of using shoulders for supporting the stripper, the support is provided by the stripper bolts

The necessary preloading of the stripper springs in this design is accomplished in the original assembly by drawing up the sleeve until it comes home against the body of the stripper bolts The springs can be preloaded to the length of the threads on the stripper bolts To all practical purposes this should be sufficient

An incidental advantage of this type of design is that the stripping mechanism can be dismantled and replaced without removing the punch, should this ever be necessary This advantage is of importance when the punch is to be sealed into place with matrix If shoulder support is used as in Fig 14 the punch sleeve and springs must be assembled at the same time and it would not be practical to use matrix because the stripper sleeve and springs would interfere

Part I of Mr Kaiser's series will appear in an early number

This Firm Practices What It Preaches

For fifteen years it's paid us to practice what we preach insists Crompton & Knowles Loom Works, Worcester Mass Preachings

Maintain a cash depreciation fund to keep production machinery modernized

Each year replace at least ten per cent of your least efficient equipment

In setting the annual sum to be added to your depreciation fund be guided by conservative accounting practice even though the amount is too high to be allowed for income tax purposes

Don't make the depreciation fund a paper account Have it in the form of ready cash or the equivalent—liquid ready to use

Don't base your depreciation charges on original costs, second hand markets, or appraisers' valuations Use the current cost of the newest, most modern equipment—of what you need, not of what you have

Flame machining

BY J G MAGRATH AIR PEDUCTION COMPANY

II—Gouging by means of the oxyacetylene torch has many uses and is a time saver as compared to other methods

A GROWING DEMAND is being experienced for a fast economical method of removing defective welds disclosed by the X ray or gamma ray The chipping hammer a slow method at best fails to meet increasing production requirements The oxyacetylene flame machining process for flame gouging used for many years for gouging out defects in steel stocks in the steel mill and in the foundry and forge shop is rapidly being accepted as an economical means of meeting production and cutting costs

Where light weight plate $\frac{1}{4}$ and $\frac{5}{8}$ in thickness can be laid out in large areas with their edges butted and tack welded the process serves for manual gouging the necessary full U groove in the abutting edges After welding the joined plates are turned over and the root of the weld is then manual gouged preparatory for welding

A number of applications to this process have proved satisfactory

Removal of tack welds defective welds roots of welds defects in steel castings forgings plate etc Removal of welds from temporary brackets holders lifting plates flanges from pipe heads from boilers Removal of scale congested tubes from boiler heads and manual grooving for plate edge preparation

All steels as hereinbefore mentioned as being flame machinable for plate edge preparation (AM Vol 81 page 156) may be flame gouged observing the same precautions

The use of the oxyacetylene torch for these applications offers a number of distinctive advantages over mechanical chipping of welds and grooves including

Speed The process proceeds at a forward speed of 1 to 3 linear ft per min

Accuracy With required correct technique a tolerance of $\frac{1}{64}$ in on width and depth can be maintained

Quiet A feature of all oxyacetylene process Dirt and vibration are absent

Portability The light weight apparatus provides for quick set ups in shop yard or field

Economy Its speed saves operating time There are no tools to be repeatedly reconditioned

Control Operated on low oxygen pressures providing low velocity oxygen flow which allows control of direction in guiding path of gouge or groove

Flexibility Ability to operate in ordinary inaccessible spaces

Oxyacetylene flame gouging employs standard cutting torches and supplementary oxyacetylene apparatus For manual gouging a hand cutting torch with either a 90 75 or 45 deg head is preferred by operators As used With correct technique a gouge or groove of predetermined contour and dimension is made in the metal without completely penetrating through the work as in severing with flame cutting Different sized tips working pressures degree of angle and technique provide for variation in shape width and depth of gouge or groove

Width of gouge is primarily a matter of tip size Several different available size tips allow for gouge widths of $\frac{1}{4}$ to $\frac{1}{16}$ in Tips for making gouges of less or greater widths can be had on order Depth of gouge is a matter of angle of impingement primarily and oxygen pressure and forward speed secondarily To deepen the gouge the

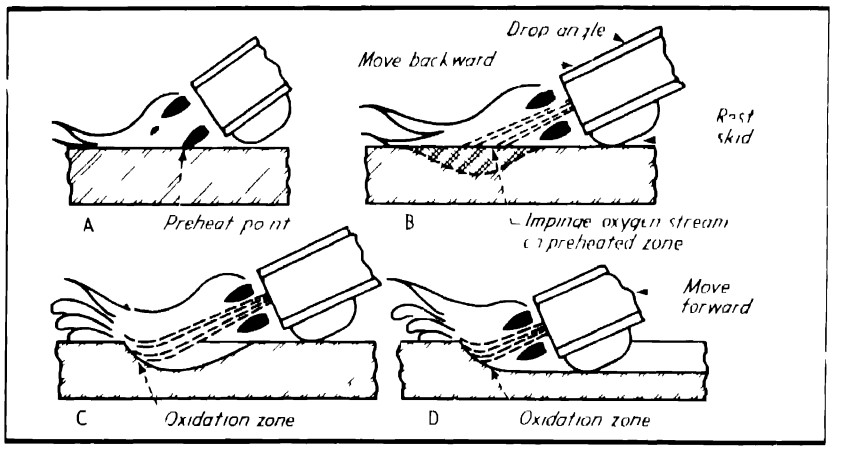


Fig 10—For manual progressive gouging the tip takes the positions illustrated in these side views

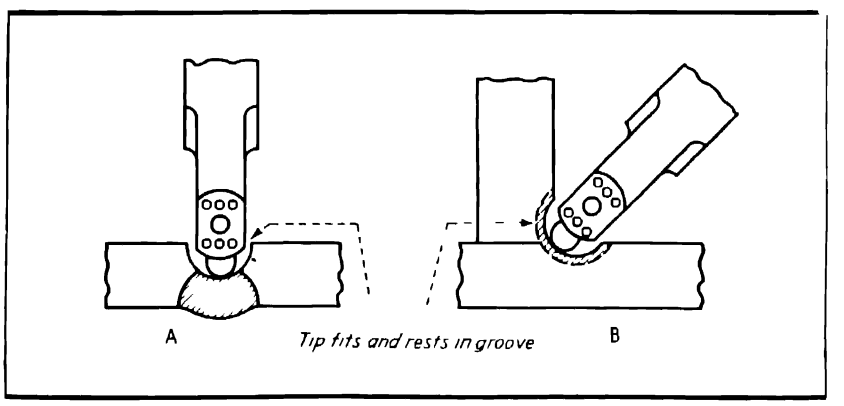
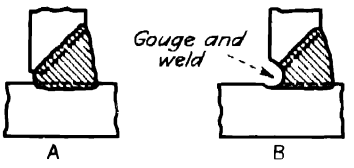
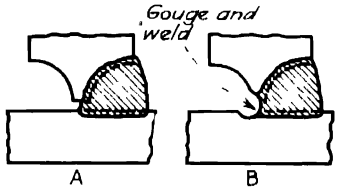


Fig 11—Flat sides of the tip makes it possible to enter deep grooves



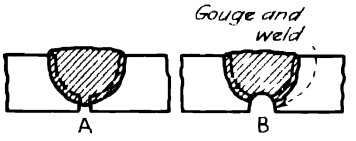
Gouging root of single bevel

FIG.12



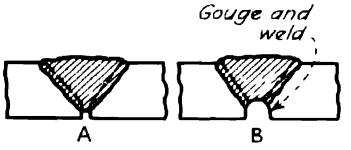
Gouging root of double J

FIG.15



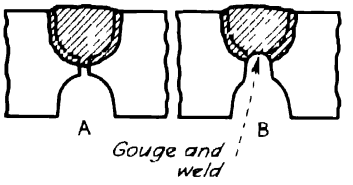
Gouging root of U groove butt joint (light plate)

FIG.18



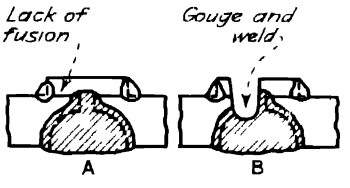
Gouging root of single V butt joint

FIG.19



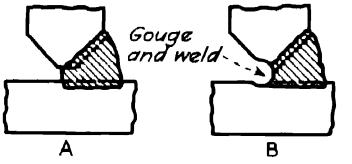
Gouging root of double U groove butt joint (medium plate)

FIG. 22



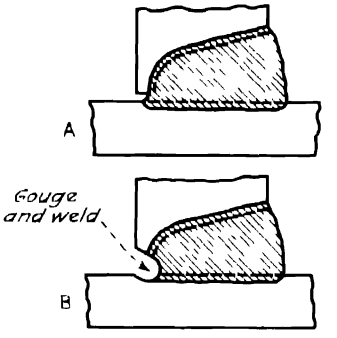
Gouging defects beneath permanent back-up strip

FIG. 25



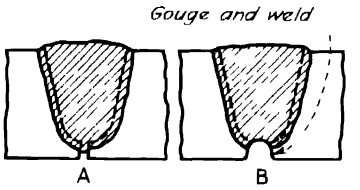
Gouging root of double bevel

FIG.13



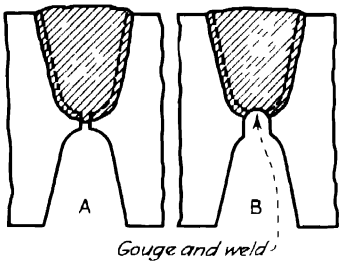
Gouging root of single J (heavy plate)

FIG.16



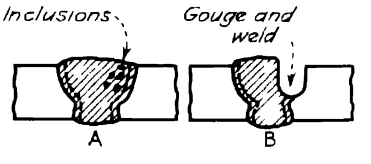
Gouging root of U groove butt joint (heavy plate)

FIG. 20



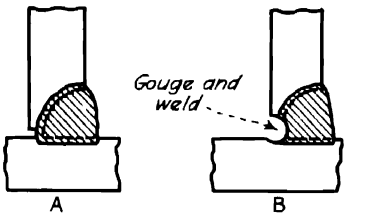
Gouging root of double U groove butt joint (heavy plate)

FIG. 23



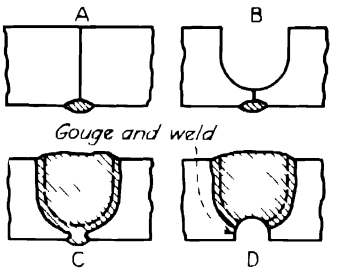
Gouging out foreign inclusions

FIG.26



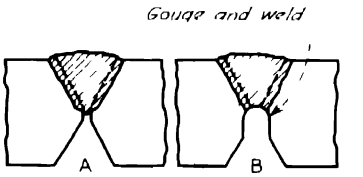
Gouging root of single J (light plate)

FIG.14



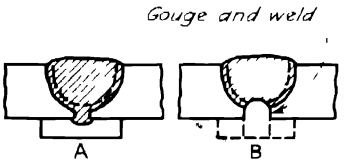
Gouging both sides of tack welded butt joint (light plate)

FIG.17



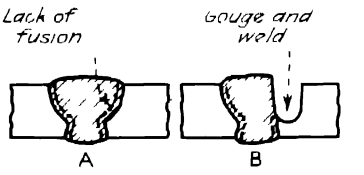
Gouging root of double V butt joint

FIG.21



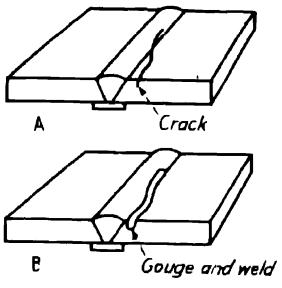
Gouging off temporary back-up strip

FIG. 24



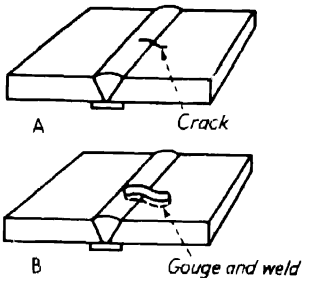
Gouging out unfused areas

FIG. 27



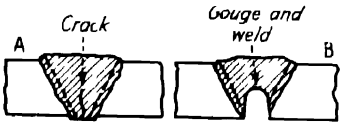
Gouging out longitudinal cracks

FIG. 28



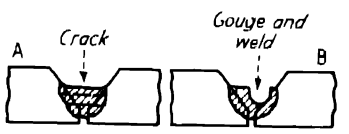
Gouging out transverse cracks

FIG 29



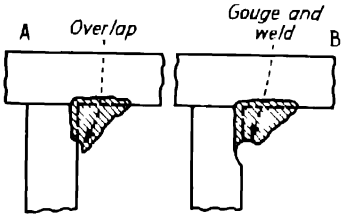
Gouging out root cracks

FIG. 30



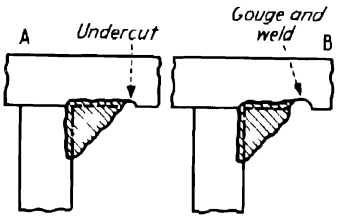
Gouging out longitudinal layer crack

FIG 31



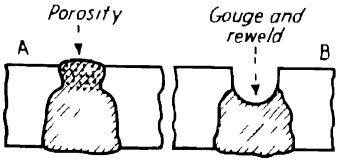
Gouging out overlaps

FIG 32



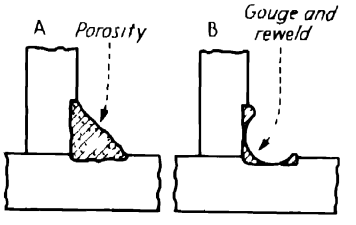
Gouging out undercuts

FIG 33



Gouging out completely imperfect butt welds

FIG. 34



Gouging out completely imperfect fillet welds

FIG. 35

angle of impingement and oxygen pressure is increased and the forward speed reduced To reduce the depth, providing a shallow gouge the angle of impingement and oxygen pressure is decreased and the forward speed is accelerated

The condition of the resulting edges with respect to cleanliness smoothness and sharpness is a matter of manual skill and proper regulation of the impingement angle, oxygen pressure and speed Insufficient oxygen pressures and speed may result in a rippled bottom surface Higher pressures than those required may cause the loss of the cut

In the removal of completely defective welds, the roots of welds, backing up strips and manual grooving for U grooves on edge butted plates or for special conditions, the manual progressive method is employed A tip of the proper size to give the required width is chosen and pressures adjusted to provide the proper depth The tip head is held at an angle of 30 to 45 deg to the horizontal or vertical plane of the surface allowing the inner preheat flames to touch the surface to allow for preheating See Fig 10*A* When the surface reaches the kindling temperature the angle between the tip and the surface is reduced to between 15 and 20 deg and simultaneously, the tip is drawn backward for a distance of $\frac{1}{4}$ to $\frac{1}{2}$ in and the oxygen is gradually released to impinge upon the preheated zone as shown in Fig 10*B*

As soon as oxidation of the metal occurs, Fig 10*C*, the forward motion is started See Fig 10*D* Sufficient speed is maintained to keep the slag puddle ahead of the reaction zone and to hold the cut The hard faced steel skid on the bottom of the tip head provides for maintaining the correct elevation of the flames from the surface and prevents the tip sticking in the groove The flat sides of the tip allows for entering in deep grooves and corners as shown in Fig 11*A* and *B* If the direction of the weld or groove is other than a straight line the gouging may follow such path by gradually swinging the tip in the horizontal plane in the direction required the same as one would with a chipping hammer During this procedure, the angle of the flame impingement must remain constant

Defective Welds Removed

Defective welds of short length defects beneath backing up strips deep defects in steel castings, forgings and plate are removed in much the same procedure as is employed in deseaming In manual spot gouging however it is desirable to have as narrow a gouge as possible to reduce the amount of welding necessary, and of sufficient depth to fully remove the defect for its full depth to sound metal Therefore a steeper angle of flame impingement is employed Seams and other defects will be discernible as dark streaks or areas against the red of the molten zone

The gouging tip finds its greatest use in the removal of roots of welds This is a manual operation which, with the mechanical chipping hammer is slow and difficult, but which, with the oxyacetylene flame is quietly accomplished in less than half the time

The removal of welds roots from single and double bevel, single and double V, and single and double J and U groove joints is shown in Figs 12 to 16 and 18 to 23 inclusive

When light or medium weight plates are laid out in large areas butted edge to edge and tack welded the welding groove can be manual



Fig. 36—Two ½-in. plates are butted together and tack welded before gouging



Fig. 37—Plates are reversed and a U-groove is gouged along the joint opposite the tack weld



Fig. 38—After gouging, the plates are arc-welded in the U-groove path produced by the touch

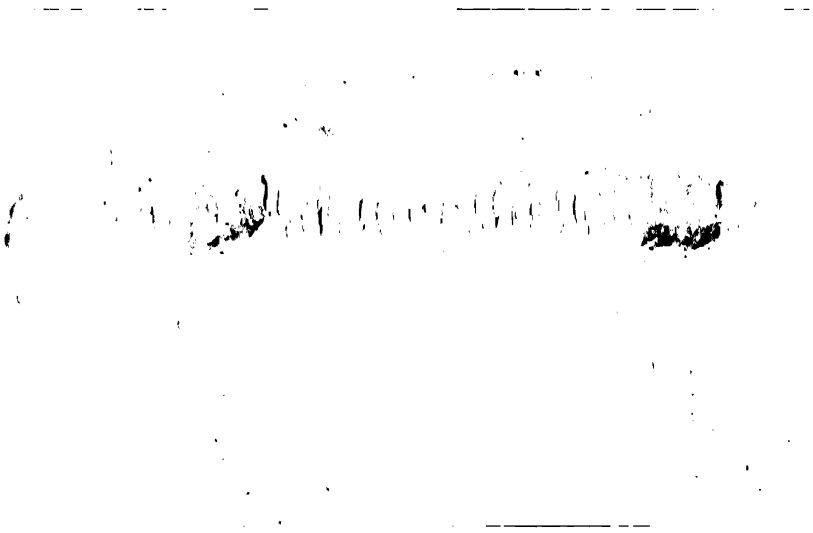


Fig. 39—A section of the weld is marked for removal by the inspector because of the disclosure of a defect by X-ray

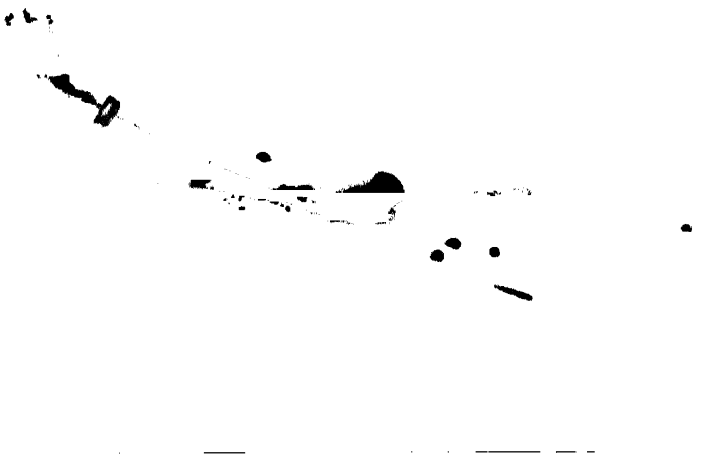


Fig. 40—Defective areas are readily removed by oxyacetylene gouging after they have been discovered by visual inspection or X-ray

gouged throughout as illustrated in Fig. 17. The sides opposite to the tack-welds receive a manual oxyacetylene U-grooving as deep as practical for good construction, and then welded. The roots of these welds, on the underside, are then removed, with the tack welds, and the edges are welded flush.

Photographic examples of this procedure are given in Figs. 36 to 38 inclusive. In Fig. 36 two plates, with edges butted, are shown tack-welded together. Fig. 37 shows a U-groove being manually gouged, along the joint, on the opposite side. A straightedge is used to aid in guiding the torch in a straight line. Note how the slag puddle moves ahead of the torch leaving the gouge reasonably clean. The U-groove is being welded in Fig. 38.

Temporary back-up strips may be removed and the root of the weld cleaned up as illustrated in Fig. 24. When the X-ray reveals defects beneath permanent back-up strips, as shown in Fig. 25, such may be removed as detailed and the gouged area welded flush with the face of the strip.

Defects in welds, such as inclusions, lack of fusion, porosity, longitudinal and transverse cracks, root and layer cracks, overlaps and undercuts are removed as illustrated in Fig. 26 to 35 inclusive.

This operation is further illustrated in the photographs Fig. 39 and 40. A weld is shown, Fig. 39, as marked by the inspector for sectional removal. This is one of a series in which the X-ray has disclosed defects beneath the surface. In Fig. 40 the oxyacetylene flame is removing the defective area.

For faster run-in

Running in valuable machinery can be a nerve-racking task. Colloidal graphite added to oil helps do the job more safely

NOT SO LONG AGO many a mechanic kept a bar of Sapolio handy for rubbing on a bearing when it had to be run in. Others favored putting a handful of flake graphite or mica into the oil. These rough-and-ready ingredients tended to prevent galling or seizing because they furnished some lubrication even if the oil film broke down under the high pressures.

Today lubricating oils for running in machinery may incorporate extreme-pressure properties provided by the soap and by minute particles of graphite suspended in a liquid.

By definition an extreme-pressure material is one which will unite chemically with metals. Two such materials commonly used are chlorine and sulphur. Either will form an oxide layer at the metal surface, thus keeping the bearing surfaces apart.

Graphite is not an extreme-pressure material as generally defined, but its property of becoming closely bonded to the surface of metals gives a lasting lubricating quality because it cannot be squeezed out although the carrier itself may be. It has the additional advantage that it can be mixed with any good lubricating oil.

To turn an assembly of heterogeneous parts into a smoothly operating machine requires a certain amount of wearing in, so that adjacent moving surfaces work well together. Before it is usable, a newly assembled engine, machine tool, gear box or any other assembly with bearing surfaces may require hours of running in under light loads, with seizing and galling an ever-present hazard.

With proper precautions, regular good grades of lubricating oil can be used successfully for running in many types of machinery. At the same time, constituents may be added to keep the parts clean and avoid gummy deposits which otherwise might have to be removed before shipping the machine. If lightly loaded and if temperatures are carefully watched, no difficulty will be experienced with regular lubricating oils. Their chief disadvantage is the necessity for stopping the machine to permit it to cool down before continuing the running in. Engine manufacturers have solved this problem by connecting individual lubricating oil systems to a central oil-circulating arrangement.

If a reduction in total running in time is desired, the portion due to shut-down for cooling can be reduced by the use of oil containing extreme-pressure materials or colloidal graphite. Because of its ability to suspend readily in many types of carriers, colloidal graphite has been found particularly useful in this field. Its tendency to settle into the pores of the metal provides lubrication even if the oil film is broken down.

This same manufacturer has also successfully used oil with colloidal graphite for running in a large diameter cast-iron bearing. Four per cent colloidal graphite was mixed with a lubricating oil and was found to be a sufficient amount to slow down the rate of temperature rise. Reduction in cooling-off time with the specially prepared lubricant was found to give an over-all saving of 30 or 40 per cent of running-in time.

In general the amount of colloidal graphite to be added to the lubricating oil or other carrier will vary from 0.2 to 0.7 per cent. Automotive engines are being run in at lower percentages, while machine tools may use



A green six-cylinder engine is run in by one already limbered up, after which it is run under its own power. Clean oil is delivered from a centrifuging plant to the engine through a flexible tube

One machine tool manufacturer had a problem of running in gear boxes which would have been expensive to rebuild if seizing or galling took place during the operation. A close watch had to be kept on the running temperature when ordinary lubricating oils were being used during run-in. Even then the temperature rise was so rapid that there was always the possibility of ruining the gear box before it could be stopped. By using a good grade of lubricating oil with colloidal graphite, the critical temperature was reached much more slowly, with consequent improvement in temperature control. Equivalent results were achieved with good lubricants having sulphur or chlorine.

quantities up to the higher amounts.

The use of colloidal graphite with oil or some other carrier achieves other advantages also. Several manufacturers are pre-coating parts which are to be assembled later. This insures that machinery will not be started without, at least, a certain amount of lubrication present. Some of the airlines are using oil with colloidal graphite to prepare their engines for running-in after being repaired.

In no case should these materials be considered a substitute for good machining practices. Considerable trouble has been experienced because machine shops have tried to rectify inaccurate machining by using a specially treated oil or graphite.

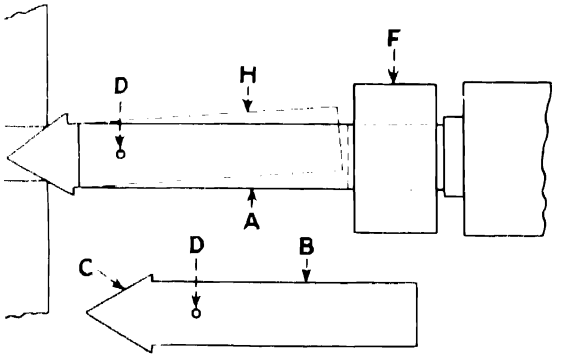
IDEAS FROM PRACTICAL MEN

Testing Alignment of Tailstock Spindles

By H. MOORE
Leeds, England

In reaming in the lathe the tailstock and headstock spindles must be in accurate alignment with each other, otherwise the hole in the work will be bell-mouthed.

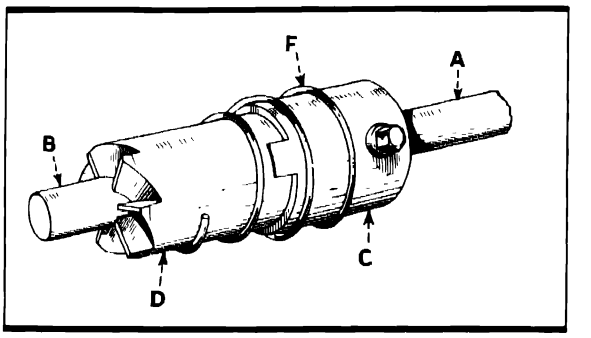
Illustrated is a simple device for testing the alignment of the two spindles. Essentially it consists of the slotted bar *A*, one end of which is tapered to fit the tailstock spindle; the piece of flat steel *B* having an arrow head at *C* and fitting in the slot in bar *A* to which it is pivoted at *D*; and the collar *F* which is a snug sliding fit on the bar. With the device in place, the bar is advanced by screwing out the tailstock spindle until the arrow head of piece *B* is in firm contact with the metal at the mouth of the hole to be reamed. If the tailstock spindle is out of alignment with the live spindle, the arrow head will not be centered in the hole and piece *B* will swing on its pivot and its tail will project beyond the surface of



Alignment of the tailstock spindle with the live spindle can be tested with this simple device. Unless the spindles are in accurate alignment the collar can not be slid along the bar

the bar, as indicated by the dotted lines *H*. In that condition collar *F* can not be slid along the bar toward the headstock because the projecting tail of piece *B* will interfere with its passage. The collar is supplied only as a convenience, to check the position of bar *B*.

To align the tailstock spindle with the live spindle, the tailstock must be adjusted so that when the arrow head of piece *B* is in contact with the metal at the mouth of the hole its tail is flush with the surface of the bar and will not interfere with sliding the collar along it when checking the alignment.



This counterbore can be used in places where a solid one would interfere with some part of the work. It is convenient for shops where such tools are used infrequently

Counterbore for Inaccessible Work

By MARTIN H. BALL

A counterbore of the type illustrated can be used in otherwise inaccessible places where the larger and shorter shank of a solid one would interfere with an overhanging wall in the work, or where it becomes necessary to pass the bare shank through a hole above the hole to be counterbored and then assemble the various parts to the shank. It is convenient for use in sizes that may not be in stock, as is the case in many shops where counterbores are not frequently used and are not stocked in proportion to other small tools.

The counterbore shank *A* is made of drill rod; pilot *B* is an integral part of the shank. The driving head *C* is attached to the shank by two quartering setscrews bearing on spots in the shank and has a tongue on each side of the bore on its lower end to engage a slot in the upper end of the cutter *D*. The friction spring *F* prevents the cutter from falling off the shank in handling and in seating it on the work.

Cutters of various diameters can be used and the pilot can either be reduced in diameter or can have a bushing placed on it to suit holes of different diameters. Where the job will warrant the extra outlay, a shank having a taper can be made, giving better driving power and reducing the cutting time.

Preventing Blow Holes in Built-Up Pistons

By A. H. CARROLL

The railroad welder is a prolific "builder-upper." About 60 per cent of his work is rebuilding worn parts back to a size that permits machining to finished dimensions. For example, piston heads are seldom changed when they become worn; a long-wearing bronze is usually welded to the bottom or worn part of

the head or bull-ring. No difficulty is entailed in doing this, providing a few simple precautions are taken.

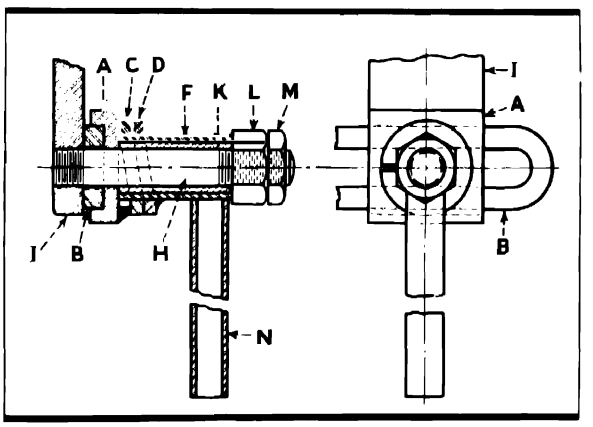
Some piston heads are porous in nature and the metal soaks up a great deal of oil. When the welder attempts to braze this piston he finds that regardless of the care he takes in applying his bronze the metal will be full of blow holes. This is caused by the eruption of the gas pockets made and liberated by the heat of the torch. To prevent this, heat the area to be brazed to a dull red and allow it to cool. Since this surface does not tin readily it is a good idea to grind the spot heated with a portable grinder.

Quick-Acting Locking Device

By R. L. AUSTIN

The device illustrated is for securely locking a hinged machine vise at any desired angle of inclination. Its advantages are that no wrench is necessary to operate it, its clamping action is quicker than could be effected by a stud and nut having threads of standard pitch, and it can be assembled from a few pieces that are readily obtainable in almost any toolroom or machine shop.

The device consists of the sliding member *A* which rides on the slotted bar *B*; the lockwashers *C* and *D*, both of which have had the "bighting" edges ground off and one of which is welded to the sliding member



Lock washers welded to opposing members, one of which can be rotated, serve as side-acting cams and lock the joint of a machine vise together when the lever is rotated

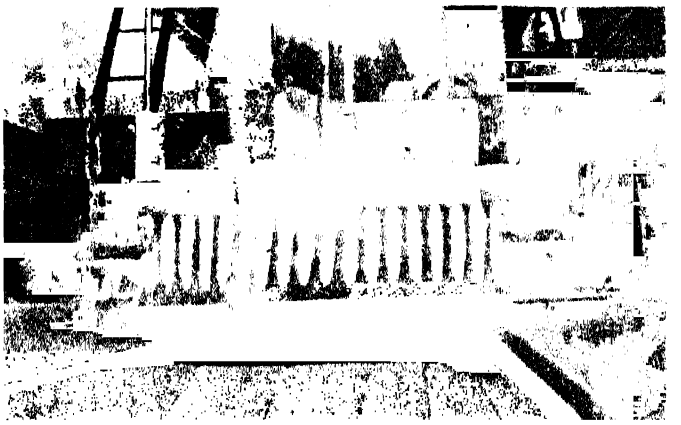
A, while the other is welded to the short piece of $\frac{3}{4}$-in. pipe *F*; the stud *H* screwed into bar *I*; the brass bushing *K*; the nut *L*; the locknut *M*; and the lever *N* welded to the short piece of $\frac{3}{4}$-in. pipe.

In operation, when the lever is rotated it rotates the short piece of $\frac{3}{4}$-in. pipe on the brass-bushed stud and carries with it lock washer *D*. Since the lock washers are in the form of a helix, one riding on the other acts as a cam and clamps the sliding member and the bars together, thus securely locking the joint and preventing the vise from moving. About a 25-deg. rotation of the lever is sufficient to lock or unlock the joint of the machine vise.

Scrap Boiler Tubes Make Good Locomotive Pilots

By ARTHUR HAVENS

Rigid and good-looking locomotive pilots can be made from scrap boiler flues and angle irons. A welder can make the entire pilot, bending his own angles for the nosepiece, top angles and back braces. Sections of scrap flues form the vertical pilot spacers.



Rigid locomotive pilots can be welded complete from scrap angle irons and boiler tubes. Shearing the tubes to length, flattens them sufficiently for welding between the top angle and the pilot nose

When the scrap flues are cut to length in the shears, they are flattened just enough for welding. These are cut in pairs of equal length, with a slight bevel if necessary at the lower end to fit the angle iron which forms the pilot nosepiece.

Boiler plate can be flame cut and used with suitable braces at the ends of the pilot to form the steps. They are then riveted to the end members. Such pilots are made in standard sizes to be interchangeable for locomotives of different types. Obviously, this eliminates the use of numerous jigs and fixtures in the fabrication and maintenance of the pilots.

Spring Tension Varied Automatically

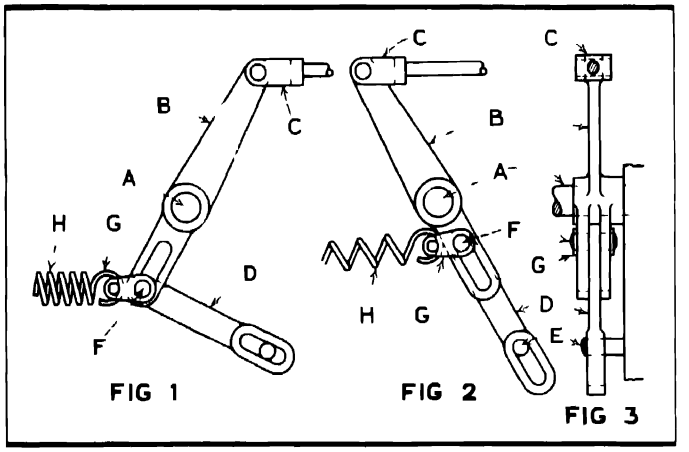
By L. KASPER

On a wire-forming machine, a shaft was to be given an irregular oscillating motion from an open or external cam, a spring being used to maintain contact of the cam follower with the cam. Some difficulty was encountered with the operation of the machine due to the fact that a light spring failed to maintain contact of the follower on the low points of the cam, whereas a heavy spring proved too severe in passing over the high points of the cam. The sketches show how the spring tension was controlled.

Referring to Fig. 1, the rod *C* received its motion from a distant cam, transmitting it to the shaft *A* through the lever *B*. Lever *B* is forked and slotted at its lower end to receive the pin *F* in the slot and the link *D* in the fork. Link *D* is slotted at its lower end to slide on the pin *E* attached to a stationary part of the machine. The yoke *G* serves as a fastening

point for the spring H which acts through lever B to maintain contact between the cam and its follower

In Fig 1 the cam follower is at the low point of the cam and the tension of spring H is lowest As the rod C is moved to the left by the cam, the forked end of lever B swings to the right the increase in spring tension being directly produced by the increase in the length of spring H The movement of lever B causes the link D to slide downward on the pin I As the pin L contacts the upper end of the slot in link D the latter is restrained from further downward movement and oscillates on pin I as a center The oscillation of link D produced by continued movement of lever B causes pin I to rise in the slot in the forked end of lever B, until at the high point of the cam the position of the pin I is as shown in Fig 2 A comparison with Fig 1 indicates that the effective



Where a spring is used to maintain contact between a cam and cam follower this arrangement of levers vary the spring tension and enables the cam follower to maintain uniform contact at all points on the cam

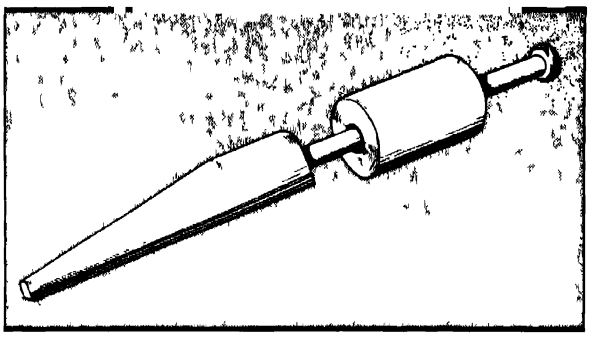
length of the arm of lever B has been considerably reduced thereby resulting in a relative reduction in the pressure of the cam follower on the cam at its high point In other words although the tension of spring H is considerably greater in Fig 2 than in Fig 1 the resistance to the movement of the rod C is considerably less than if pin I and yoke G had remained in fixed position relative to the center of shaft A

The purpose of the slot in the lower end of link D is to permit some initial build up of spring tension and also to permit some adjustment in the length of the rod C Fig 3 is an end view of the assembly

A Handy Key for Knocking Out Taper-Shank Drills

By H E HAGEMAN

The key for knocking out taper shank drills and sleeves from spindles frequently does not enter the tang slot deep enough to stay in place without being held This makes it necessary for the machine operator to use one hand to hold the key while the other wields a hammer leaving the drill point to fall where it may



This combined key and hammer is a handy tool for knocking out taper-shank drills and sleeves from machine spindles

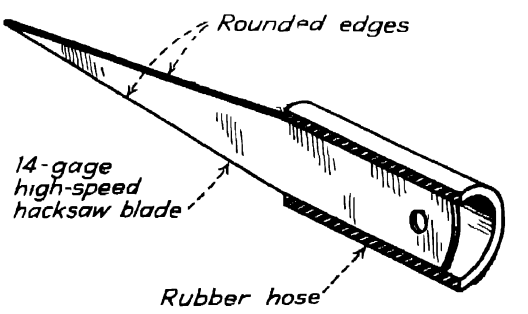
It probably was with this thought in mind as well as that it saves reaching for a hammer that the combined key and hammer here described was devised The dimensions given are for use with No 1 Morse shanks

This device is simply a key of standard shape forged with a shank about $\frac{1}{2}$ in diameter and 7 in long on which is loosely mounted a piece of cast iron about $2\frac{1}{4}$ in diameter and 1 in long The iron is retained by a substantial head formed on the end of the shank by upsetting Obviously the tool is used by sliding the cast iron hammer back and forth on the shank after the manner of a battering ram

Hacksaw Blade Makes Good Scratch Awl

By A G ALDEN
Shop Superintendent
[illegible] Manufacturing Works

Our sheet metal department experienced considerable difficulty in finding scratch awls with lasting qualities for working on black sheet iron So we devised awls made from scrap pieces of high speed hack saw blades by simply grinding a piece to a point and driving a piece of rubber hose on the large end for a handle The corners of the awl need to be well rounded so as not to damage the straight edge We find this 'home made' tool to be entirely satisfactory and the cost—only a few minutes of labor



Involute-Spline Standards—III

Courtesy of the American Standards Association

THESE STANDARDS for side-bearing involute splines are intended to serve as a basis for the design of interchangeable spline shafts and fittings. They were developed by the Sectional Committee on the Standardization of Small Tools and Machine Tool Elements, which is sponsored by the National Machine Tool Builders' Association, the S.A.E. and the A.S.M.E. More or less deviation from the standard will be necessary

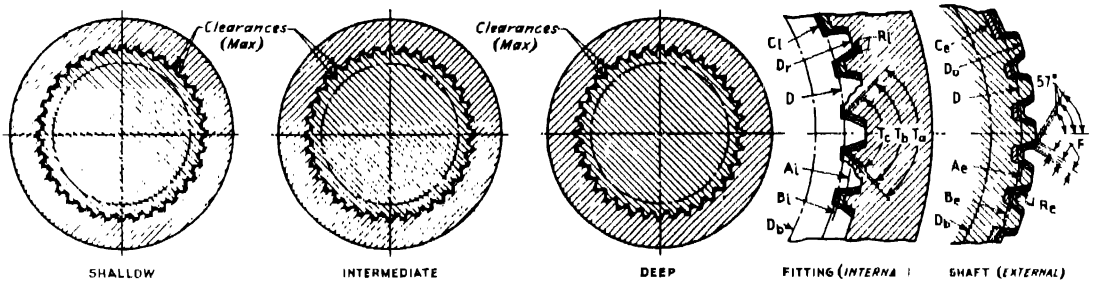


Table 9 Dimensions of 30 Deg Involute Splines With 36 Teeth—Fitting (Internal)

Corresponding Ball or Roller Bearing Bores		Pitch Diameter	Diametral Pitch	Base Diameter	Root Diameter		Inside Diameters						Radius or Broach Chamfer		Circular Width of Space at the Pitch Line		
							Shallow		Intermediate		Deep				Shallow	Intermediate	Deep
		D_b			D_r		A_i		B_i		C_i		R_i		T_s	T_i	T
Bearing Number	Bore in Mm	D		$D \times 0.8660254$	1.070D Max	1.060D Min	1.030D Max	1.029D Min	1.010D Max	1.009D Min	0.990D Max	0.989D Min	0.006D Max	Nil Min	$D \times 0.008011$	$D \times 0.001090$	$D \times 0.055514$
04	20	0 7500	48 0000	0 64952	0 803	0 795	0 773	0 772	0 758	0 757	0 743	0 742	0 0045	0 000	0 0510	0 0463	0 0416
05	25	0 9375	38 4000	0 81190	1 003	0 994	0 966	0 965	0 947	0 946	0 928	0 927	0 0056	0 000	0 0638	0 0578	0 0520
06	30	1 1250	32 0000	0 97428	1 204	1 193	1 159	1 158	1 136	1 135	1 114	1 113	0 0067	0 000	0 0765	0 0694	0 0625
07	35	1 3125	27 4286	1 13666	1 404	1 391	1 352	1 350	1 325	1 324	1 299	1 298	0 0079	0 000	0 0893	0 0810	0 0729
08	40	1 5000	24 0000	1 29904	1 605	1 590	1 545	1 543	1 515	1 514	1 485	1 483	0 0090	0 000	0 1020	0 0925	0 0833
09	45	1 6875	21 3333	1 46142	1 806	1 789	1 738	1 736	1 704	1 703	1 671	1 669	0 0101	0 000	0 1148	0 1041	0 0937
10	50	1 8750	19 2000	1 62380	2 006	1 988	1 931	1 929	1 894	1 892	1 856	1 854	0 0112	0 000	0 1275	0 1157	0 1041
11	55	2 0625	17 4545	1 78618	2 207	2 186	2 124	2 122	2 083	2 081	2 042	2 040	0 0124	0 000	0 1403	0 1272	0 1145
12	60	2 2500	16 0000	1 94856	2 408	2 385	2 317	2 315	2 273	2 270	2 227	2 225	0 0135	0 000	0 1530	0 1388	0 1249
13	65	2 4375	14 7692	2 11094	2 608	2 584	2 511	2 508	2 462	2 459	2 413	2 411	0 0146	0 000	0 1658	0 1504	0 1353
14	70	2 6250	13 7143	2 27332	2 809	2 783	2 704	2 701	2 651	2 648	2 599	2 596	0 0157	0 000	0 1785	0 1619	0 1457
15	75	2 8125	12 8000	2 43570	3 009	2 981	2 897	2 894	2 841	2 838	2 784	2 781	0 0169	0 000	0 1913	0 1735	0 1561
16	80	3 0000	12 0000	2 59808	3 210	3 180	3 090	3 087	3 030	3 027	2 970	2 967	0 0180	0 000	0 2040	0 1851	0 1665
17	85	3 1875	11 2941	2 76046	3 411	3 379	3 283	3 280	3 219	3 216	3 155	3 152	0 0191	0 000	0 2168	0 1966	0 1770
18	90	3 3750	10 6667	2 92284	3 611	3 578	3 476	3 473	3 408	3 405	3 341	3 338	0 0202	0 000	0 2295	0 2082	0 1874
19	95	3 5625	10 1053	3 08522	3 812	3 776	3 669	3 666	3 598	3 595	3 527	3 523	0 0214	0 000	0 2423	0 2198	0 1978
20	100	3 7500	9 6000	3 24760	4 013	3 975	3 862	3 859	3 788	3 784	3 713	3 709	0 0225	0 000	0 2550	0 2313	0 2082
21	105	3 9375	9 1429	3 40998	4 213	4 174	4 056	4 052	3 977	3 973	3 898	3 894	0 0236	0 000	0 2678	0 2429	0 2186
22	110	4 1250	8 7273	3 57235	4 414	4 373	4 249	4 245	4 166	4 162	4 084	4 080	0 0247	0 000	0 2805	0 2545	0 2290

All dimensions are given in inches

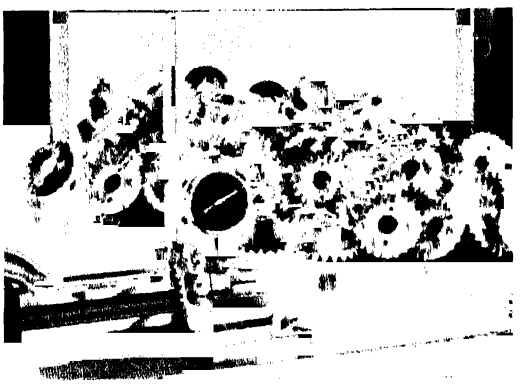
Table 10 Dimensions of 30 Deg Involute Splines With 36 Teeth—Shaft (External)

Corresponding Ball or Roller Bearing Bores		Pitch Diameter	Diametral Pitch	Base Diameter	Outside Diameter		Root Diameters						Radius		Chamfer or Broken Edge		Minimum Recommended Major Diam of Involute Profile
							Shallow		Intermediate		Deep						
		D_b			D_o		A_e		B_e		C_e		R_e		F		
Bearing Number	Bore in Mm	D		$0.8660254 \times D$	Max	Min	1.010D Max	1.000D Min	0.990D Max	0.980D Min	0.970D Max	0.960D Min	0.006D Max	Nil Min	0.003D Max	Nil Min	
04	20	0 7500	48 0000	0 64952	0 7876	0 783	0 757	0 750	0 743	0 735	0 727	0 720	0 0045	0 000	0 0022	0 000	0 784
05	25	0 9375	38 4000	0 81190	0 9845	0 980	0 947	0 937	0 928	0 919	0 909	0 900	0 0056	0 000	0 0028	0 000	0 980
06	30	1 1250	32 0000	0 97428	1 1813	1 176	1 136	1 125	1 114	1 102	1 091	1 080	0 0067	0 000	0 0034	0 000	1 176
07	35	1 3125	27 4286	1 13666	1 3783	1 373	1 326	1 312	1 299	1 286	1 273	1 260	0 0079	0 000	0 0039	0 000	1 371
08	40	1 5000	24 0000	1 29904	1 5751	1 570	1 515	1 500	1 485	1 470	1 455	1 440	0 0090	0 000	0 0045	0 000	1 567
09	45	1 6875	21 3333	1 46142	1 7720	1 767	1 704	1 687	1 671	1 654	1 637	1 620	0 0101	0 000	0 0051	0 000	1 763
10	50	1 8750	19 2000	1 62380	1 9688	1 964	1 894	1 875	1 856	1 837	1 819	1 800	0 0112	0 000	0 0056	0 000	1 959
11	55	2 0625	17 4545	1 78618	2 1658	2 161	2 083	2 062	2 042	2 021	2 001	1 980	0 0124	0 000	0 0062	0 000	2 155
12	60	2 2500	16 0000	1 94856	2 3626	2 358	2 272	2 250	2 227	2 205	2 182	2 160	0 0135	0 000	0 0067	0 000	2 351
13	65	2 4375	14 7692	2 11094	2 5595	2 555	2 462	2 437	2 413	2 389	2 364	2 340	0 0146	0 000	0 0073	0 000	2 547
14	70	2 6250	13 7143	2 27332	2 7563	2 751	2 651	2 625	2 599	2 572	2 546	2 520	0 0157	0 000	0 0079	0 000	2 743
15	75	2 8125	12 8000	2 43570	2 9532	2 948	2 841	2 812	2 784	2 756	2 728	2 700	0 0169	0 000	0 0084	0 000	2 939
16	80	3 0000	12 0000	2 59808	3 1500	3 145	3 030	3 000	2 970	2 940	2 910	2 880	0 0180	0 000	0 0090	0 000	3 135
17	85	3 1875	11 2941	2 76046	3 3469	3 342	3 219	3 187	3 156	3 124	3 092	3 060	0 0191	0 000	0 0096	0 000	3 331
18	90	3 3750	10 6667	2 92284	3 5437	3 539	3 409	3 375	3 341	3 307	3 274	3 240	0 0202	0 000	0 0101	0 000	3 527
19	95	3 5625	10 1053	3 08522	3 7406	3 736	3 598	3 562	3 527	3 491	3 456	3 420	0 0214	0 000	0 0107	0 000	3 723
20	100	3 7500	9 6000	3 24760	3 9374	3 932	3 787	3 750	3 712	3 675	3 637	3 600	0 0225	0 000	0 0112	0 000	3 919
21	105	3 9375	9 1429	3 40998	4 1343	4 129	3 977	3 937	3 898	3 859	3 819	3 780	0 0236	0 000	0 0118	0 000	4 115
22	110	4 1250	8 7273	3 57235	4 3311	4 326	4 166	4 125	4 084	4 042	4 001	3 960	0 0247	0 000	0 0124	0 000	4 311

All dimensions are given in inches

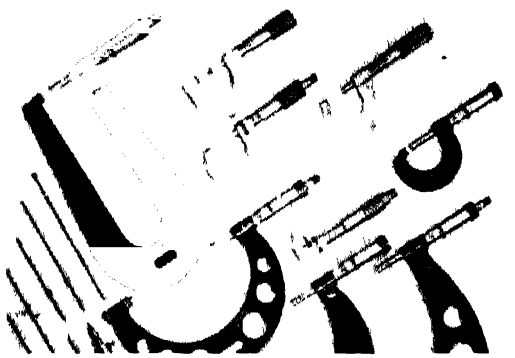


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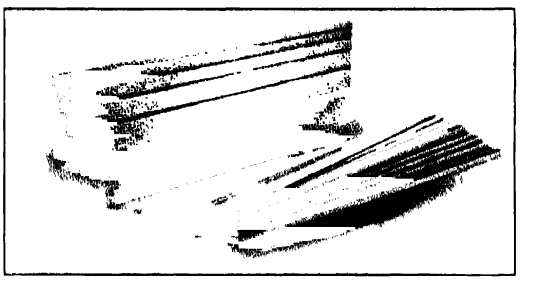
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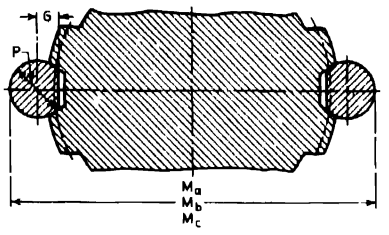
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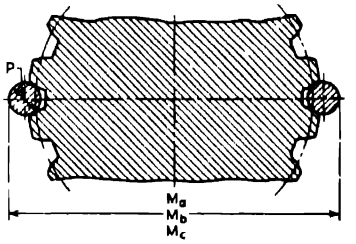
Involute-Spline Standards—III

to meet conditions imposed by engineering or production requirements.

The standard provides an option of three depths in each of five series covering 6, 10, 16, 24 and 36 tooth splines. The intermediate depth will probably be the most used, but it can be varied depending on the hardness of the spline members. Dimensions for 6, 10, 16 and 24 tooth splines have been published (AM Vol 84, pages 131, 133, 173 and 175).



For 6 and 10 Tooth Splines



For 16, 24 and 36 Tooth Splines

Table 1 Measurement of Involute Splines With 6 and 10 Teeth on Shafts

Corresponding Bearing Bore Numbers	6-Tooth Splines						10-Tooth Splines					
	Pitch Diameter	Pin Diameter	Center to Flat	Measurement Over Pins			Pitch Diameter	Pin Diameter	Center to Flat	Measurement Over Pins		
				Shallow	Interm	Deep				Shallow	Interm.	Deep
		P	G	M_a	M_b	M_c		P	G	M_a	M_b	M_c
	D	D × 0.3660253	0.4P	D × 1.601561	D × 1.590770	D × 1.580365	D	D × 0.2012936	0.4P	D × 1.327740	D × 1.315660	D × 1.303923
04	0.7500	0.2745	0.110	1.2012	1.1931	1.1853	0.7500	0.1510	0.060	0.9958	0.9867	0.9779
05	0.9375	0.3431	0.137	1.5015	1.4913	1.4816	0.9375	0.1887	0.075	1.2448	1.2334	1.2224
06	1.1250	0.4118	0.165	1.8018	1.7896	1.7779	1.1250	0.2265	0.091	1.4937	1.4801	1.4669
07	1.3125	0.4804	0.192	2.1020	2.0879	2.0742	1.3125	0.2642	0.106	1.7427	1.7268	1.7114
08	1.5000	0.5490	0.220	2.4023	2.3862	2.3705	1.5000	0.3019	0.121	1.9916	1.9735	1.9559
09	1.6875	0.6177	0.247	2.7026	2.6844	2.6669	1.6875	0.3397	0.136	2.2406	2.2202	2.2004
10	1.8750	0.6863	0.275	3.0029	2.9827	2.9632	1.8750	0.3774	0.151	2.4895	2.4669	2.4449
11	2.0625	0.7549	0.302	3.3032	3.2810	3.2595	2.0625	0.4152	0.166	2.7385	2.7135	2.6893
12	2.2500	0.8236	0.329	3.6035	3.5792	3.5558	2.2500	0.4529	0.181	2.9874	2.9602	2.9338
13	2.4375	0.8922	0.357	3.9038	3.8775	3.8521	2.4375	0.4907	0.196	3.2364	3.2069	3.1783
14	2.6250	0.9608	0.384	4.2041	4.1758	4.1485	2.6250	0.5284	0.211	3.4853	3.4536	3.4228
15	2.8125	1.0294	0.412	4.5044	4.4740	4.4448	2.8125	0.5661	0.226	3.7343	3.7003	3.6673
16	3.0000	1.0981	0.439	4.8047	4.7723	4.7411	3.0000	0.6039	0.242	3.9832	3.9470	3.9118
17	3.1875	1.1667	0.467	5.1050	5.0706	5.0374	3.1875	0.6416	0.257	4.2322	4.1937	4.1563
18	3.3750	1.2353	0.494	5.4053	5.3688	5.3337	3.3750	0.6794	0.272	4.4811	4.4404	4.4007
19	3.5625	1.3040	0.522	5.7056	5.6671	5.6301	3.5625	0.7171	0.287	4.7301	4.6870	4.6452
20	3.7500	1.3726	0.549	6.0059	5.9654	5.9264	3.7500	0.7549	0.302	4.9790	4.9337	4.8897
21	3.9375	1.4412	0.576	6.3061	6.2637	6.2227	3.9375	0.7926	0.317	5.2280	5.1804	5.1342
22	4.1250	1.5099	0.604	6.6064	6.5619	6.5190	4.1250	0.8303	0.332	5.4769	5.4271	5.3787

All dimensions are given in inches

Table 2 Measurement of Involute Splines With 16, 24, and 36 Teeth—on Shafts

Corresponding Bearing Bore Numbers	16-Tooth Splines					24-Tooth Splines					36-Tooth Splines				
	Pitch Diameter	Pin Diameter	Measurement Over Pins			Pitch Diameter	Pin Diameter	Measurement Over Pins			Pitch Diameter	Pin Diameter	Measurement Over Pins		
			Shallow	Interm.	Deep			Shallow	Interm.	Deep			Shallow	Interm	Deep
		P	M_a	M_b	M_c		P	M_a	M_b	M_c		P	M_a	M_b	M_c
	D	D × 0.1205850	D × 1.199013	D × 1.186008	D × 1.173280	D	D × 0.0786596	D × 1.147595	D × 1.133819	D × 1.120219	D	D × 0.0517190	D × 1.116248	D × 1.106751	D × 1.097297
04	0.7500	0.0904	0.8993	0.8895	0.8800	0.7500	0.0590	0.8607	0.8504	0.8402	0.7500	0.0388	0.8372	0.8301	0.8230
05	0.9375	0.1130	1.1241	1.1119	1.1000	0.9375	0.0737	1.0759	1.0630	1.0502	0.9375	0.0485	1.0465	1.0376	1.0287
06	1.1250	0.1357	1.3489	1.3343	1.3199	1.1250	0.0885	1.2910	1.2755	1.2602	1.1250	0.0582	1.2558	1.2451	1.2345
07	1.3125	0.1583	1.5737	1.5566	1.5399	1.3125	0.1032	1.5062	1.4881	1.4703	1.3125	0.0679	1.4651	1.4526	1.4402
08	1.5000	0.1809	1.7985	1.7790	1.7599	1.5000	0.1180	1.7214	1.7007	1.6803	1.5000	0.0776	1.8744	1.6601	1.6459
09	1.6875	0.2035	2.0233	2.0014	1.9799	1.6875	0.1327	1.9366	1.9133	1.8904	1.6875	0.0873	1.8837	1.8676	1.8517
10	1.8750	0.2261	2.2481	2.2238	2.1999	1.8750	0.1475	2.1517	2.1259	2.1004	1.8750	0.0970	2.0930	2.0752	2.0574
11	2.0625	0.2487	2.4730	2.4461	2.4199	2.0625	0.1622	2.3669	2.3385	2.3105	2.0625	0.1067	2.3023	2.2827	2.2632
12	2.2500	0.2713	2.6978	2.6685	2.6399	2.2500	0.1770	2.5821	2.5511	2.5205	2.2500	0.1164	2.5116	2.4902	2.4689
13	2.4375	0.2939	2.9226	2.8909	2.8599	2.4375	0.1917	2.7973	2.7637	2.7305	2.4375	0.1261	2.7209	2.6977	2.6747
14	2.6250	0.3165	3.1474	3.1133	3.0799	2.6250	0.2065	3.0124	2.9763	2.9406	2.6250	0.1358	2.9302	2.9052	2.8804
15	2.8125	0.3391	3.3722	3.3356	3.2999	2.8125	0.2212	3.2276	3.1889	3.1506	2.8125	0.1455	3.1391	3.1127	3.0861
16	3.0000	0.3618	3.5970	3.5580	3.5198	3.0000	0.2360	3.4428	3.4015	3.3607	3.0000	0.1552	3.3487	3.3203	3.2918
17	3.1875	0.3844	3.8219	3.7804	3.7398	3.1875	0.2507	3.6580	3.6140	3.5707	3.1875	0.1649	3.5580	3.5278	3.4976
18	3.3750	0.4070	4.0467	4.0028	3.9598	3.3750	0.2655	3.8731	3.8266	3.7807	3.3750	0.1746	3.7673	3.7353	3.7034
19	3.5625	0.4296	4.2715	4.2252	4.1798	3.5625	0.2802	4.0883	4.0392	3.9908	3.5625	0.1842	3.9766	3.9428	3.9091
20	3.7500	0.4522	4.4963	4.4475	4.3998	3.7500	0.2950	4.3035	4.2518	4.2008	3.7500	0.1939	4.1859	4.1503	4.1149
21	3.9375	0.4748	4.7211	4.6699	4.6198	3.9375	0.3097	4.5187	4.4644	4.4109	3.9375	0.2036	4.3952	4.3578	4.3206
22	4.1250	0.4974	4.9459	4.8923	4.8398	4.1250	0.3245	4.7338	4.6770	4.6209	4.1250	0.2133	4.6045	4.5653	4.5264

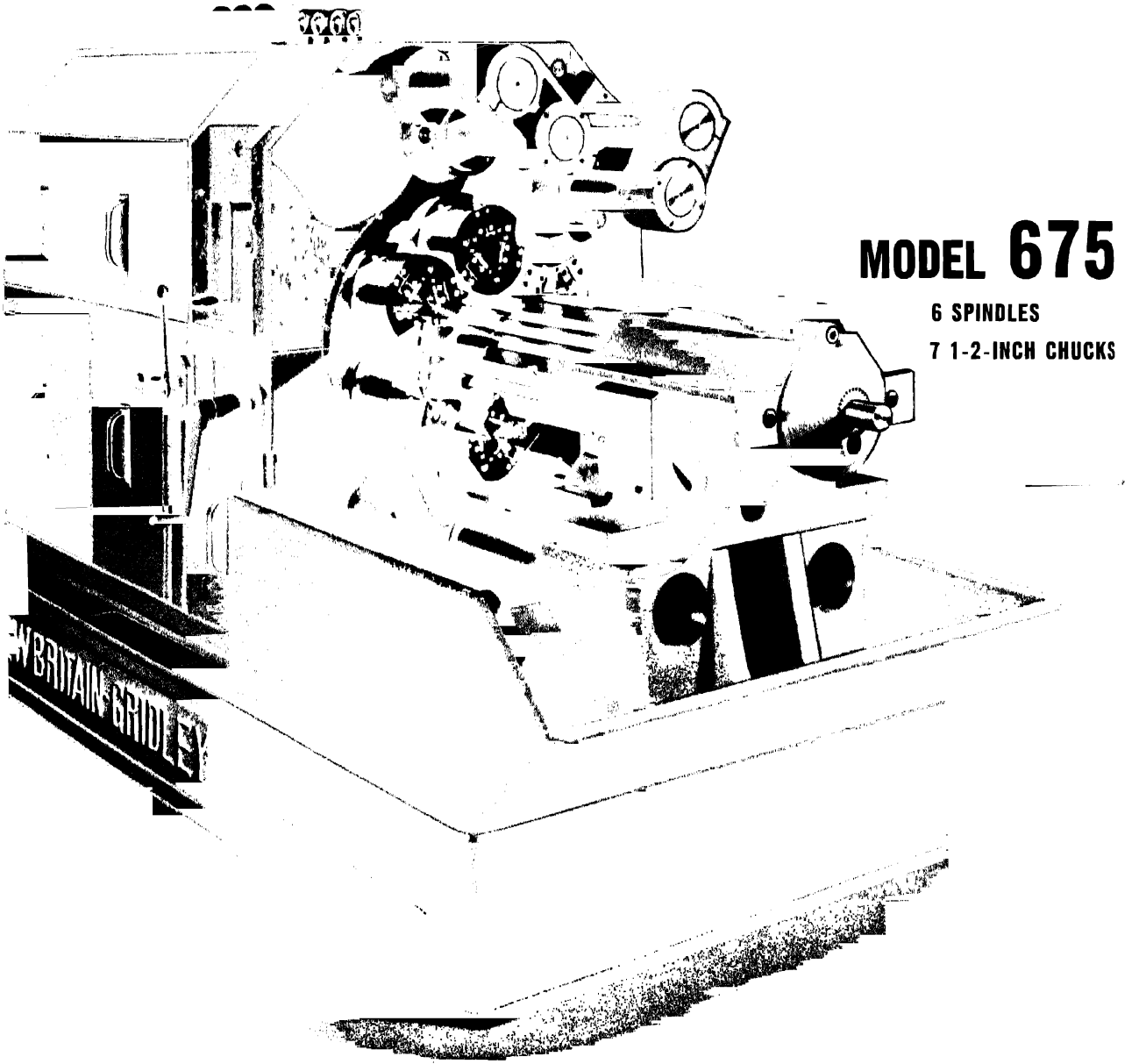
All dimensions are given in inches.

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Also a complete line of Screw Machines — Four and Six Spindles to 2¼" Capacity

Defense Bottlenecks

WE HAVE BEEN HEARING a lot about bottlenecks in national defense. You don't have to visit the Army and Navy in Washington to get an earful on the subject. Just read the newspapers or listen to the radio or, for that matter, drop in at any gathering place.

What is meant by bottlenecks? If you asked most people that question, they probably wouldn't know. Here is the best explanation we can give: Americans went on their own sweet way for years paying little or no attention to defense matters. The armed forces were starved for funds. Manufacture of munitions fell away to next to nothing. A group of intellectual writers smeared munitions makers with the title "Merchants of Death." But what of it?

Well, nothing, until one day recently we woke up to the realization that we are living in a world largely ruled by the strong-arm nations. We got scared at our own softness and at our inability to command respect armed with popguns and feather dusters. So Congress began to appropriate billions, a habit which it has fallen into lately.

But mere appropriation of billions doesn't solve anything in itself, as we have discovered in connection with unemployment. We must have everything for defense purposes immediately or sooner! Guns, airplanes, shells, tanks.

Unfortunately that is impossible. It will take months, perhaps even years to attain the defense goal some have set for us.

How are we going to speed up the process as much as possible? Not by imposing rigid restrictions on work-weeks, not by the Government's refusing to liberalize its write-offs on plant additions designed for defense production, not by waiting until every t is crossed and every i dotted before munitions contracts are placed.

Bottleneck in machine tools? Not if we know it. Any industry with an average business of $100,000,000 a year which can pull itself up by its bootstraps to an output of $400,000,000 a year can meet any emergency which might arise. It already has functioning a voluntary system designed to give the defense program the green light over everything else. It has in its hand a trump or two yet to play if things get tight.

We are not concerned about the industrial bottlenecks which people like to talk about and which the newspapers like to write about. Given half a chance, American industry will be able to give a sterling account of itself in the manufacture of war goods.

What we are more afraid of than industrial bottlenecks is the Washington bottleneck. For some inexplicable reason the hardest job many government officials have to do is to use the scissors to cut the red tape which binds them. It is impossible for manufacturers even to begin tooling for munitions manufacture until they know what they are to make and how much of it and until they are sure the job is "in the bag."

So we are forced to the conclusion that if a choke point exists today, it is in Washington rather than in the industrial hinterland. And if we know Bill Knudsen as we think we do, he will eliminate that choke point in a hurry if he is given the authority.

Burnham Finney

GAGING BUSINESS

Machine tools on British order to be delivered to U. S. plants holding British munitions contracts. Japan has $26,000,000 of U. S. tools on order. June was big month for machine builders

Machine Tools June bookings are reported by many companies to have been the best of the year British orders were large Aviation companies and makers of industrial electrical equipment were among the biggest domestic buyers, much of the purchasing being for armament programs Pratt & Whitney Aircraft, Wright Aviation Manufacturing and Bethlehem Steel have been among the important companies in the market Government arsenals and navy yards also have been placing generous orders

The British have taken over all French machine tool contracts in the United States with the exception of a few highly specialized units unadaptable to British work Instead of shipping huge quantities of machine tools to England for installation there, it is believed that most U S machines currently on British order will be delivered to plants in this country holding British munitions contracts Heretofore practically all machines bought by the British have been shipped overseas

British orders here, including those acquired from the French, are said to total over $125,000,000 The French alone had 11 500 machines on order Early in June U S machine tool builders had on hand Japanese business amounting to $26,000,000 and Russian business totaling $9,000,000 Most of the machines for Russia are understood to have been shipped since then, but few of those for Japan The severe control of machine tool exports clamped down by Washington is expected to make it difficult for Japan to get the machines she needs, unless the equipment is so specialized that it cannot be converted to U S defense purposes

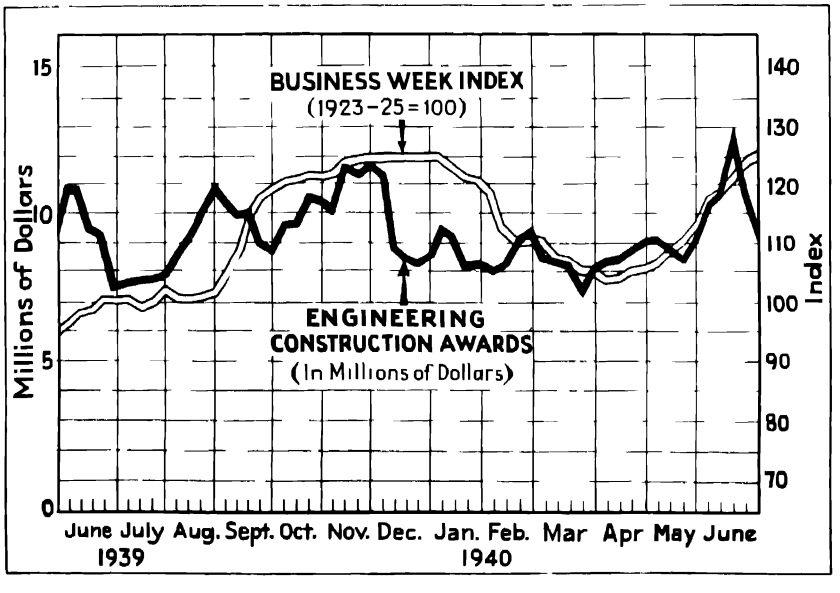
Ordnance The War Department is expected to spend around $10,000,000 for a new powder making plant, an ammunition loading plant and enlargement of productive facilities at Springfield Armory The new naval bill, passed by the House and certain of enactment by the Senate, provides $50,000,000 for expansion of ordnance-making capacity and $20,000,000 for added armor plate capacity Despite a record peacetime procurement program for fiscal 1941 the Army's Ordnance Department still expects to place a large number of educational orders in coming months Westinghouse, which turned out huge quantities of munitions in World War days, has formed an Emergency Products Division to produce ordnance material for the government It is reported to have received an order for guns to be made at its Jersey City plant

Railroad Equipment– Freight car orders and inquiries the past fortnight totaled almost 10 000 units Programs recently announced indicate that $250,000 000 may be spent in the final half of 1940 for rolling stock, with emphasis on mill type freight cars because of the necessity for moving raw and finished steel products Railroads now have 35,784 more cars in service than in October, 1939 Outstanding inquiries include 3 000 cars for the Illinois Central, 2,315 for the Pennsylvania and 2,275 cars and 20 locomotives for the Southern Pacific

Aircraft U S military plane production is estimated at about 500 units a month but plant expansions will increase that rate sharply in the next four months Vega, Vultee, Consolidated and North American are among companies enlarging their factories A leading plane builder is contemplating tripling its capacity Wright, Pratt & Whitney and Allison are making considerable progress in adding to their engine output The latter hopes to be up to 400 units a month within six weeks It now is producing about 10 units a day Packard will spend $30,000 000 in tooling up for Rolls Royce engine production Continental Motors, Stearman Aircraft and Aviation Manufacturing have received further substantial government orders recently

Shipbuilding– Contracts for new docks at Norfolk and Philadelphia Navy yards costing $16 175 000 are a forerunner of other contracts to increase capacities in private as well as government yards Actual construction work on new private facilities may be delayed because of the reported reluctance of the U S Treasury Department to liberalize taxation valuations and depreciation rates in connection with this emergency program Operations at navy yards can be further expanded by adding more shifts, but a shortage of certain types of skilled labor is a limiting factor General Motors Fairbanks Morse and Hooven Owens Rentschler have received large orders for submarine propulsion machinery

Steel After a decline during the holiday week, steel production bounced back up this week Only a minor fraction of today's tonnage is coming from the new defense program The major effect of armament activities will not be felt for some time Meanwhile domestic demand and British buying are expected to maintain operations at a high rate



LICENSES NEEDED FOR MACHINE TOOL EXPORTS

Industrial mobilization plan virtually put into effect. Metal-working equipment, materials and parts come under rigid scrutiny. Lt. Col. Maxwell will be Administrator

WASHINGTON — Immediately upon signing H R 9850, which virtually puts into effect the 1939 industrial mobilization plan of the War Department, President Roosevelt issued a proclamation putting all export shipments of munitions, materials or machinery needed in the national defense program under rigid control

All machine tools, as well as many other kinds of metal-working machinery, are on the list for export control The Presidential proclamation includes "metal working machinery for (1) melting or casting (2) pressing into forms (3) cutting or grinding, power-driven, and (4) welding" Armor plate, optically clear plastics, and aircraft parts equipment and accessories are on the list The group of basic materials and products consists, in part, of aluminum chromium industrial diamonds manganese molybdenum, tungsten and vanadium

Lieut-Col Russell L Maxwell has been appointed by Mr Roosevelt as Administrator of Export Control He will have final authority even exceeding that of the State Department in determining whether products on the affected list may be exported Actual licenses for shipments abroad must be obtained from the State Department No exports may be made without a license

It was in anticipation of this action that machine tools destined for Japan and Russia, in particular, were held up recently, precipitating a vigorous protest from the Japanese ambassador The upshot is that such holdups temporarily ceased With an official control in effect, however, the government will clamp down again It is believed that only a few machines not adaptable to our defense needs will hereafter slip through to Japan The same situation applies to contemplated shipments to many other countries

Some equipment destined for Britain probably will be taken for the Army and Navy, but not enough to interfere with the British getting most of what they want

The new Export Administrator, Lt-Col Maxwell, has his office in Room 2068 Munitions Building in Washington Since last August he has been Chief of the Planning and Equipment Branch of the War Department General Staff From December, 1938, to August 1939 he was assistant to the executive officer in the office of the Assistant Secretary of War He has served in ordnance operations having been on duty in the office of the Chief of Ordnance on three separate occasions In 1934 1935 he was executive assistant to the Chief of the Philadelphia Ordnance District and later was ordnance officer at Langley Feld Va He was commanding officer of the Picatinny Arsenal from October 1918, to January, 1919, and was with the American forces in Germany as commanding officer of the Hallaschlag and Mulheim Ammunition plants from July 1919, to July 1921 He is a West Point graduate

EXPORT LICENSE INSTRUCTIONS

FOR MACHINE TOOLS

1. One duplicate application should be made for each complete shipment to any one consignee, and may not include more than one commodity nor shipments to more than one country.

2. Applications should be typewritten, but will be considered if written legibly in ink Unsigned applications or those omitting essential information called for will be returned

3. The commodity listed should be designated clearly and specifically, the type and model designation being included whenever applicable Values listed should represent the selling price only of the articles exported, and should not include such supplementary costs as packing, freight, etc

4. When countersigned and impressed with the seal of the Department of State, an application becomes a license.

5. Any attempt to export a commodity differing in any way from that licensed or any alteration of a license, except by a duly authorized officer of the government, is punishable under appropriate acts of Congress Changes in the information set forth in licenses which have been issued under the seal of the Secretary of State can be effected by amendments which can be made only by the Department of State, or by collectors of customs or postmasters acting under the specific instructions of the Department of State.

6. A license is not transferable and is subject to revocation without notice

7. Shipment must be made from port of exit within one year from date license is granted.

8. Export licenses must be filed with the collector of customs at the port from which the shipment is departing from the United States prior to the proposed departure.

BRITISH ASSUME FRENCH ORDERS

NEW YORK —The British Purchasing Mission will positively take over all the French machine tool orders in this country The number is estimated to be 11,500 For those machines tied in with the metric system making the problem of conversion difficult a solution is now being worked out by the Mission It probably will be ten days to two weeks before the French orders are completely straightened out and transferred to the British

Navy Orders 45 New Warships At Total Cost of $414,000,000

WASHINGTON — The Navy has moved nearer its goal of superiority over any probable fleet combination on earth by ordering 45 new warships at a cost of $414,000,000 It calls for 11 cruisers, 20 destroyers 13 submarines and one large seaplane tender, all to be built in private yards as follow Bath Iron Works 6 destroyers, Bethlehem steel Co 8 cruisers and 4 destroyers, Electric Boat Co 13 submarines, Federal Shipbuilding & Dry Dock Co - 10 destroyers, New York Shipbuilding Corp 3 cruisers and 1 seaplane tender The terms of this 45-ship deal do not cover armament, armor and ammunition, or propelling machinery for the submarines

This order is in addition to all recently announced contracts A few days ago the Navy let contracts for 19 vessels in its own yards Also, orders have been awarded the Newport News Shipbuilding and Dry Dock Co for two cruisers and three aircraft carriers Altogether there are 92 warships under construction, totaling 499,435 tons which will cost $1 140,000,000

The 70 per cent expansion bill just passed by the House and now before the Senate provides of an additional eight or nine battleships seven aircraft carriers, 30 cruisers, 120 destroyers and 47 submarines The bill is only an authorization and does not provide appropriations

The two-ocean navy ships for which are either built, under construction or proposed, will consist of more than 30 battleships, at least 15 aircraft carriers, 400 destroyers, and a swarm of light and heavy cruisers.

Labor Rivalry a Threat to Defense Plans; Hillman Achieves Success As Peacemaker

NEW YORK — One of the major threats to uninterrupted defense production has been the prospect of CIO - AFL jurisdictional wrangling that might tie up vital industries For the last three years the launching of an organizing campaign by the CIO has been the signal for a countermove by the AFL designed to halt CIO expansion

Specter Dispersed

With two industries which are crucial to defense preparation largely unorganized aircraft manufacture and machine tools — the specter of labor tugs-of war which would hamper production in these fields has given planners nightmares CIO's United Automobile Workers Union and United Electrical Radio and Machine Workers and AFL's International Association of Machinists each claim a jurisdictional stake Determinedly staking out such claims would mean strikes and chaos

That defense minded Washington was sensitive to such potential trouble is indicated by the Roosevelt appointment of labor leader Sidney Hillman to the key post of Employment Policies Coordinator in the recently established Defense Advisory Council Hillman's job as Stettinius looks after raw materials and Knudson gets armament manufactured is to keep on tap an adequate labor supply It is because picket lines can cork up a labor bottleneck in short order that Hillman's job is that of peacemaker

Long an ardent and vocal champion of labor unity even when it put him at sixes and sevens with Generalissimo John I Lewis Hillman after the AFL went through the motions of protesting his appointment because he heads a CIO union can command the respect of all temperate sections of the labor movement Addressing himself to the problem one of his first official acts upon assuming his new position was to call in R J Thomas president of CIO Auto Workers Union and H W Brown chief of AFL's machinists for a down-to-earth confab

The result of that meeting was that these two leaders whose respective organizations had had a daggers drawn attitude toward each other agreed on each other's jurisdiction saw to it that there was no spot for conflict and proceeded to shake hands as token that they would respect each other's field

Further Peace Moves

Hillman's next step to insure effective labor peace in spite of the Lewis Green hostility was to create a national Labor Policy Advisory Committee whose formation was announced July 2 The new committee's personnel is made up of eight AFL leaders six CIO union chiefs and two officials from the railroad brotherhood unions These men represent organizations who have well over a million members employed in industries important to the defense effort That after five years of bitter AFL CIO factional war these organizations could come together discarding personal and organizational differences in a pledge of united and cooperative effort in furtherance of the national defense program is a heartening sign Observers are suggesting that it presages labor unity

KNUDSEN APPOINTS AIDES

WASHINGTON —Mason Britton vice-chairman of the McGraw-Hill Publishing Co Inc has been appointed to the staff of William S Knudsen of the National Advisory Defense Commission to assist in the procurement of machine tools for the defense program A B Finig Motch & Merryweather Machinery Co and Don Laflin Giddings and Lewis Machine Tool Co also have been appointed to assist Mr Knudsen

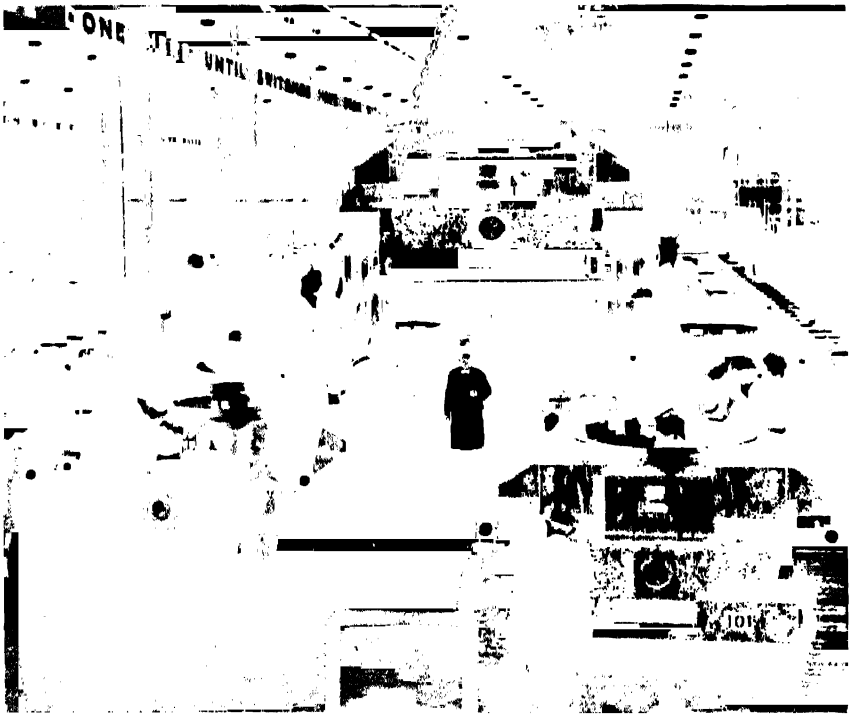
MORE POWER FOR ALLIED BUYERS

OTTAWA—Beginning July 1 C D Howe Minister of Munitions and Supply in Canada and Arthur B Purvis purchasing agent in the United States took over complete control of British war purchases on this continent This removes at a stroke all the overseas restrictions which since the war started have slowed up Allied purchasing on this side of the ocean The British War Supply Board has disappeared it was not only responsible for purchases in Canada but exercised control over the British Purchasing Commission in the United States

MACHINERY EXPORTS DECLINE

WASHINGTON —Exports of power driven metal-working machinery in May amounted to $19 142 225 compared with $21 281 332 in April Both months are well over the exports for May 1939 which was $11 615 799

Exports in May included engine lathes $1 393 405 turret lathes $1 - 657 448 thread cutting and automatic screw machines $1 729 593, milling machines $2 315 698 drilling machines $932 470 grinders $3 321 - 142 sheet and plate metal-working machines and parts $756 652 and forging machinery parts and accessories $1 261 457



Land Battleships—*Cruiser tanks equipped with revolving turrets are assembled at a depot somewhere in the English Midlands One of the tanks is seen being lifted over others for final assembling Peak production is rapidly being approached by British factories*

Recent Bills Give Administration More Power; Set Up New Pattern for Military Procurement

WASHINGTON—In the landslide of defense legislation last month, major attention went to the appropriation bills that so far added up nearly $5,000,000,000 for armament But at the same time a group of bills slid through which set up a brand new pattern for military procurement Designed primarily to speed up production for a vast new army and navy, the bills sweep aside the cautious restrictions which usually surround government buying and grant broad powers which, if pushed to their limits, could regiment industry into a virtual industrial mobilization Secondarily, the new regulations aim to prevent profiteering and to keep labor from bearing the burden of defense These new powers expire June 30, 1942.

Competitive bidding will not enter into the expansion program Army and Navy can now negotiate contracts on everything they buy, and, except on minor and routine items they are going to use the power The cost-plus-a-percentage contracts of the last war are forbidden, but contracts may be negotiated on a lump sum or on a cost-plus-a-fixed-fee basis The latter form will probably be used only on construction work for the present The fee shall not exceed 7 per cent of the cost

Profit limitations are imposed on producers of ships and of Army and Navy airplanes Profits of other contractors are not restricted, but excess profit legislation will be enacted to keep builders of tanks, machine guns and other munitions from making too much money Restrictions on ship and airplane builders come in through a tightening of the Vinson-Tramel Law which formerly restricted ship profits to 10 per cent and airplane to 12 per cent These limits are now reduced to a uniform 8 per cent of the contract price To cover cases in which the cost is less than anticipated, it is also stipulated that profit shall not exceed 7 per cent of the cost of performing the contract The same limits apply to subcontracts if over $25,000 Although these percentages look liberal, many manufacturers fear that, because of tax and overhead items not counted as costs, actual profits will not exceed 4 or 5 per cent

An important concession is made to shipbuilders and plane manufacturers on the matter of distributing cost of plant expansion and tooling In a program such as the present involving great expansion of capacity, it is vital how much of the cost of new facilities may be charged against the contract as a legitimate cost Previously, this determination has been made, after the contract award, by the Treasury, which has simply allowed the same amortization rate as for income tax The new legislation provides that the determination be made before the contract is awarded and that it be made by the Army and Navy—who have long been fighting for a more liberal interpretation Treasury retains only veto power over each decision (which, some fear, may produce delaying deadlocks)

Limitations on ship and plane profits—and probably on other items through taxation create the danger of deadlock in negotiations between purchasing officers and manufacturers To meet this eventuality, the legislation empowers Army and Navy to manufacture what they need for their own account To this end, they may build plants or lease existing plants and either operate them themselves or contract for their operation The Secretary of the Navy, moreover, if he finds that he needs a plant, may determine a fair compensation and compel the owner to lease it to him The Secretary of War, curiously enough is not granted this power

Application of Walsh-Healey requirements of prevailing wage, and time-and-a-half after 40 hours to defense production was bitterly opposed by the military, but Congress ended by throwing the problem in the President's lap The restrictions remain in force, but the President is empowered to waive them if he finds it desirable Civilian employees of Army, Navy, and Coast Guard, hitherto restricted to a maximum work-week of 40 hours may now be required to work longer if paid time and a half

Priority System for Machine Tools Established in Canada

MONTREAL A priority system for machine tools has been established in Canada It will function through the newly-formed Citadel Merchandising Co, fully owned by the government which will have dictatorial authority over machine tool production and shipments The new organization extends beyond machine tools, being charged with responsibility for insuring the supply of all equipment essential to Canadian war industries

The new company is managed by business leaders independent of all machine tool companies It is operated on a non-profit basis and will have offices in Montreal and representatives in New York and Ottawa It already is attempting to coordinate production and procurement of machine tools in Canada and to assist firms occupied with war orders to obtain adequate equipment

The new company is to be operated under the direct supervision of Hon C D Howe, minister of munitions and supply, and will be administered by the following directors, all of whom are to serve without remuneration. Thomas Arnold, chairman, Manitoba Steel Foundries Ltd, president, L J Belnap, president Consolidated Paper Corp, Ltd, vice president, J D Johnson, president Canada Cement Co, Ltd, C E Gravel, director, Bell Telephone Co of Canada; F J Morrow, director, Ogilvie Flour Mills Co Ltd

Government control of machine tool production is but a part of a wide program for the mobilization of Canadian industry by the government for war purposes Other boards have been formed such as the Wartime Industries Control Board consisting of controllers for various branches of industry each of whom has dictatorial powers over anything affecting the industries

The WICB will elect a chairman from its own members which include Hugh Scully Ottawa, steel controller, G C Bateman, Toronto, controller of metals production, H R McMillan, Vancouver, timber controller; and G Cotrelle, Toronto, oil controller President of Federal Aircraft Ltd is R P Bell, head of Pickford & Black, Ltd and the directors are S Dawes, B Gordon, R Smith, and A Aiken

EDUCATIONAL ORDERS CONTINUED

WASHINGTON—The 1941 Educational Orders Program is getting under way Supported by an appropriation of $16,250,000 the War Department is issuing circular proposals on many of what it terms as "sixty critical items" Only those companies not having regular war orders are eligible to bid Although it was previously predicted that big scale war orders would submerge the Educational Orders Program, such is not the case and indications are that it will go on as long as there are firms that can aid defense and which need experience

RECENT OUTSTANDING WAR ORDERS

WASHINGTON—The White Motor Co of Cleveland, Ohio has recently been awarded a $5,387,500 contract by the government for scout cars with spare parts, while the Sperry Gyroscope Co. has been awarded a $4,571,887 contract for anti-aircraft fire control instruments The Wright Aeronautical Corp was awarded a contract for $1,488,272 engines

Administration Moves to Train 250,000 Men for Industrial Jobs

WASHINGTON—Last week the Administration, in its first important move to remedy the lack of trained workers for defense industries started the enrollment of 150 000 men in the nation's vocational schools under allotment of $9 781 340 of WPA funds and $7 500 000 of $15 000 000 recently voted to the Office of Education by Congress The program is in charge of Sidney Hillman member of the National Defense Commission The NYA will train an additional 100 000 men

About 50 000 enrollees will be taken from WPA rolls The balance will be selected by state and federal employment services Some will be employed men who wish to improve their skill Vocational training facilities of public schools will be utilized by the Office of Education Local officials and representatives of employers and labor will advise WPA trainees will receive regular pay

Classes will be held in July August and September, at about 600 schools Courses will average 40 to 42 hours for 10 weeks Occupations will include aircraft mechanics machinists sheet metal workers welders pattern makers blacksmiths riveters lathe operators punch press operators drill press draftsmen Engineering schools can give instruction in testing instrument making machine tool manufacture specification writing and blue printing but this higher type seems not likely to be emphasized just yet

In addition more than 100 000 young men are being trained for industry and technical skills needed in the supply of equipment by the National Youth Administration John Haien Director of youth training for the Chrysler Corporation will be in charge of this program

The Army and Navy are pushing their own mechanics training program The Civil Aeronautics Authority is giving courses in mechanics in connection with its pilot program The Labor Department's Apprenticeship Committee is putting more steam behind apprenticeships by employers which however is a slow process good for only high skills and a long pull

WATCH MACHINE EXPORT ORDERS

WASHINGTON — Machinery builders have been told that they should not accept new export orders until they have been granted an export license by the Department of State To expedite handling foreign orders received prior to the President's proclamation of July 2 builders should refrain from starting to process any further machines involving metric equipment or extensive special tooling until export licenses have been favorably acted upon They have been asked to submit to the Army and Navy Munitions Board information on machines or groups of identical machines in process or finished on hand which involve metric or special equipment or special tooling Builders will be notified quickly whether export licenses will be granted for such machines

New British War Orders Stimulate Canadian Plants

MONTREAL—The Canadian Government War Supply Board and predecessor purchasing agency have placed 20 000 orders for munitions with Canadian plants in the past few months Including those placed for the British government, the value of all contracts exceeds $300 000,000 Munition orders placed in Canada by the British government directly in the past few weeks are valued at $25,000,000 Last week Canada announced its budget for the next fiscal year—$1 300 000 000

To supply such increased quantities of munitions 35 expansions in Canada are being financed by the British government At present Britain has committed over $50 000 000 for expansion while the value of the annual production is expected to be about $250 000 000 of war materials In addition Britain has guaranteed to purchase the output of the expanded plants for at least a year ahead

The British-financed plant expansion in Canada includes two explosives plants being erected at a cost of $20 000 000 Work on an $8 000 000 shell-filling plant has been started by Canadian Car and Foundry

Some thirteen plants are now making shells for the British government One plant is making 25-pounder field guns with carriages and instruments and four are turning out 3.7-in and 40-mm gun barrels

Other Canadian production for the British government includes bombing and fighting planes minesweepers and anti-submarine boats and small arms ammunition

Noorduyn Aviation Limited has received an additional order for aircraft from the Canadian government amounting to $1 226 460 which brings the total value of all aircraft ordered by Canada to over $5 000 000

Canadian Vickers Limited has unfilled orders on its books of approximately $9 000 000 for aircraft as well as small naval craft

Colonel Campbell Heads New Ordnance Facilities Division

WASHINGTON — Lt - Col Levin Campbell, formerly head of the artillery and ammunition department at the Frankford Arsenal has been transferred to Washington in full charge directly under General Harris of the newly created Facilities Division of the Ordnance Department His department will have responsibility for all shell, ammunition and powder-producing facilities Major E C Bomar succeeds him at Frankford Col Burton O Lewis, heretofore at Aberdeen Proving Grounds, has been made special assistant to General Harris at Washington

U. S. Government Contracts Awarded to Metal-Working Firms

Defense Contracts on Page 517

Contractor	Govt Agency	Commodity	
U S Motors Corp Oshkosh Wis	Signal Corps	Power units	$104 800
General Electric Co Schenectady N Y	CIO LVA	Electrical equipment	60 063
American Transformer Co Newark N J	Interior	Electrical equipment	81 616
Westinghouse Electric & Mfg Co East Pittsburgh Pa	Interior LVA NACA	Electrical equipment	231 616
Allis-Chalmers Mfg Co Milwaukee Wis	LVA Navy	Electrical equipment	62 018
Cutler Hammer Inc Milwaukee Wis	Interior	Electrical equipment	67 08
Cessna Aircraft Co Wichita Kan	CAA	Airplanes	99 68
B F Sturtevant Co Boston Mass	Navy	Blowers	39 21
Hardin Tynes Mfg Co Birmingham Ala	Navy	Air compressor	43 4.0
Cyclops Iron Works San Francisco Calif	Interior	Crane	2 80
Worthington Pump & Machinery Corp Harrison N J	Engineer Corps	Pump	49 986
Bay City Shovels Inc Bay City Mich	Engineer Corps	Shovels	104 200
Wolfe & Mann Mfg Co Baltimore Md	Panama Canal	Switchgear	51 9 2
Magor Car Corp New York N Y	Panama Railroad	Flat cars	200 160
Consolidated Steel Corp Los Angeles Cal	Interior	Gate hoists	82 000
American Automatic Electric Sales Co Chicago Ill	Signal Corps	Telephone equipment	81 6.6
Wallace & Tiernan Products Inc Belleville N J	Signal Corps	Lamp mountings	157 164
Cincinnati Shaper Co Cincinnati Ohio	NACA	Press brakes	$16 269
National Broach & Machine Co Detroit Mich	Ordnance	Profiling machines	24 960
R K LeBlond Machine Tool Co Cincinnati Ohio	Air Corps	Engine lathes	28 731
Plomb Tool Co Los Angeles Calif	Air Corps	Miscellaneous tools	62 896
Lodge & Shipley Machine Tool Co Cincinnati Ohio	Navy Ordnance	Lathes	86 946
Gisholt Machine Co Madison Wis	Navy	Turret lathes	17 401
American Tool Works Co Cincinnati Ohio	Air Corps	Lathes	123 873
E W Bliss Co Brooklyn N Y	Ordnance	Heading press	61 2 0
Seneca Falls Machine Co Seneca Falls N Y	Ordnance	Tool lathe	13 140

INSIDE DETROIT

Auto plants not being converted to manufacture munitions. Contracts for defense program projects not expected for six months. Normal production and model change-overs continue

BY RUPERT LE GRAND DETROIT EDITOR

DETROIT—Contrary to a widely held popular notion that auto plants are being shut down for conversion to munitions manufacture, the prosaic truth is that only the normal model changeover is now in process So far, only scattered and now insignificant educational orders have been placed in this area for shells and machine guns A few thousand trucks have been built, but the Army's requirements for say 50,000 vehicles in the first year could be handled by any of several units without great effort

It is a curious fact that political bigwigs and certain columnists know more about what the auto industry will be required to do as its part in the national defense program than the industry's leaders do themselves And these gentry apparently seem to have a better idea of what will be required than those responsible for planning the gigantic procurement programs now in progress Yet from what can be learned locally it appears that all of six months will pass before the scope of the national defense program can be determined and contracts be let

Business Men Dismayed

Local business men have been dismayed to learn that the political and business viewpoints are still poles apart in respect to procurement of national defense items They report that efforts have been made to dictate various aspects of the product to be made and the terms, but with no regard to the risks involved to the contractor In some cases, it has appeared to these men that the design of the product has not been adequately tested, and that political considerations may have had a bearing upon the choice

If the manufacturer takes such a contract against his better judgment and experience in making commercial material of somewhat similar nature he assumes all risks without compensation. A large sum could be spent tooling up and the contract cancelled if the first samples did not measure up to the government's ideas Besides the monetary loss involved, the manufacturer must consider his well-earned standing with the public. Even if he were in no wise responsible for the failure, it would be impossible to escape the blame To make such propositions still more unattractive, the government is reported to have suggested profits in the order of two to four per cent as compared with the seven per cent to be allowed on munitions contracts This is hardly sufficient compensation for normal risks and smacks of a confiscatory attitude Furthermore, there still exists an attitude of commanding that such and such be done overnight without practical consideration of the difficulties attending the process of tooling up

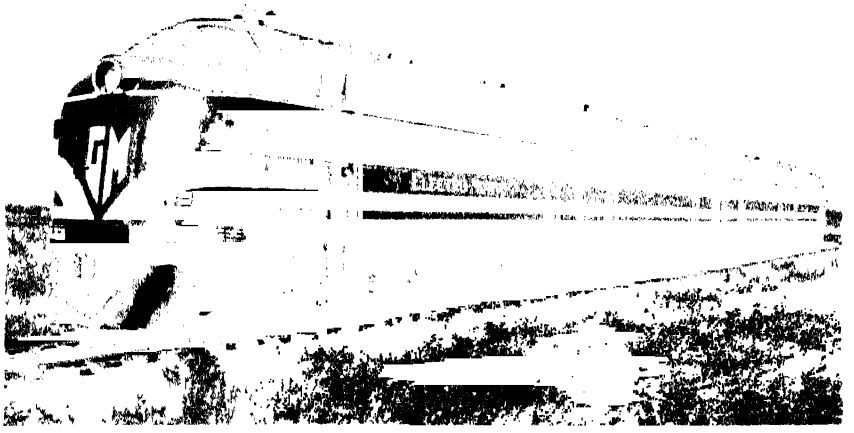
A change for the better in government-industry relations in respect to munitions contracts can be looked for when the former realizes (1) that automobile production lines need not and can not logically be converted to munitions manufacture (2) that it takes time to tool up idle facilities for production of any component in quantity, and (3) that amortization of equipment cost bears a close relationship to contract quantities not visionary expectations

Meanwhile there has been no letup in the work of estimating equipment needs and of planning production techniques for components that the government may logically ask local concerns to furnish. Ford is reported continuing activity on tooling methods for an aircraft motor and stands ready to produce it solely for American use when asked to do so Chrysler has an ordnance division hard at work estimating certain items Packard is ready to go on mass output of marine motors and possibly a related type of aircraft motor But these projects can not become actualities until definite contracts are received

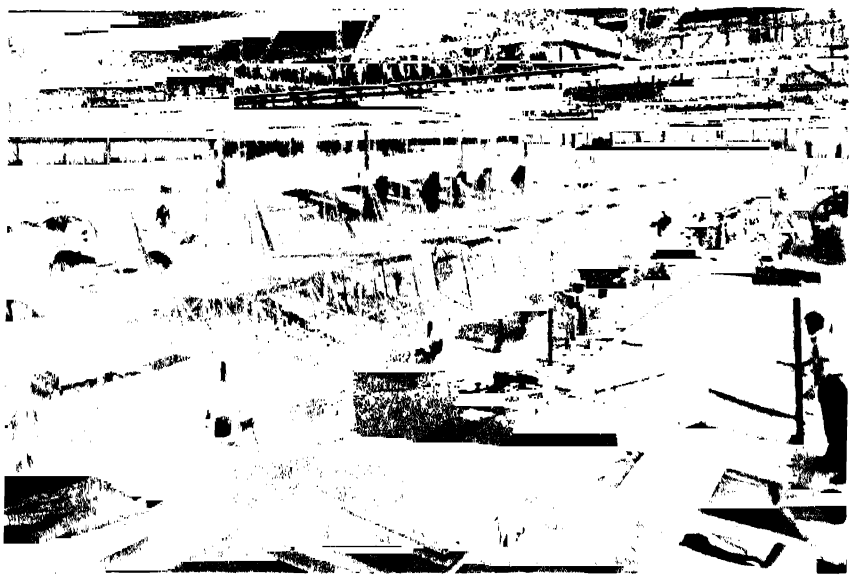
But defense planning is only a small part of activity in the auto plants at the present time Mill-

LOWDOWN ON HENRY FORD

DETROIT—There is no logical explanation for Henry Ford's throwing overboard the contract for Rolls-Royce engines The best yet found is that Henry reserves the right to do what he wants, whether anybody likes it or not He has always professed to hate war and that probably had as much to do with his decision as anything Those who think that Henry took an easy way out of trying to make good on an impossible promise (to deliver engines at a rate of 1,000 a month or better within six months) are probably wrong Ford has done much work on simplifying the Rolls engine over the past two years and may yet build it solely for U S defense purposes



Joins Heavyweight Class *Diesel-electric locomotives will be used for the first time in main line freight work by Santa Fe. Electro-Motive Corp will build two 5,400-hp units similar to this one, which has been undergoing severe tests by various railroads since last November. While initial cost is about three times that of conventional engine, operating economies are said to offset this Santa Fe is also buying ten modern steam locomotives, may get an answer to the steam vs. diesel-electric argument*



Down South – *Though ground for the Nashville Tenn plant of Stinson Division of Aircraft Manufacturing Corporation was broken only late last winter the first commercial plane ever built in the state was recently completed in it New plant cost $1 000 000 provides some 125 000 sq ft of manufacturing space Above Stinson 105's take shape*

wrights engineers and die shop personnel are the chief classes of employees in evidence in several independent plants that closed down at the end of June Three GM divisions were scheduled to go down last week or this week Some plants will reopen as early as July 17 after a shutdown of only two weeks New models are likely to appear by August 10

As asserted on previous occasions the chief modifications in 1941 models will center about extensive body changes Observations in local die shops and in the auto plants bear out this contention Generally speaking styling for 1941 will follow the example set by GM's Torpedo models Mechanical changes will not be extensive

Heavy Outlay Needed for Dies

Die programs for the new wider and lower bodies involve the greatest outlay for dies and fixtures in recent years yet additional money has been spent throughout the sheet-metal fabricating process in order to expedite assemblies obtain a better product and lower costs The dies themselves have been made more carefully if anything so that the stampings will more exactly follow the desired contour Welding-machine fixtures have been planned with a view to easier loading and to produce more accurate assemblies Metal finishing with file and hammer will largely be eliminated

New practice calls for assembling sheet-metal components in the car position wherever possible and to do so upon fixtures with supporting surfaces that accurately duplicate the contours of the master model For this reason welding machine fixtures punching machine fixtures and other equipment include elements that have been Kellered directly from the wooden or plaster models Thus these fixtures accurately duplicate the dies upon which the stampings were made and hold and locate stampings without distortion

The net result of spending more money on better dies and fixtures is a sub-assembly that more accurately fits the chassis or the body This is especially important in regard to the front-end assembly Fenders grille and apron will be assembled as a unit and dropped onto the chassis after the body instead of being placed first as is now the common practice Connections between the engine and body will be facilitated by the new final assembly method

Sheet-metal fabrication lines will be shortened by employing welding machines capable of producing as many as 240 assemblies per hour

TVA CREATES INDUSTRIAL SITES

WASHINGTON—Defense Commission's request for $25,000 000 to start a $65 000 000 expansion of TVA power supplies was turned down by a Senate committee But with the Stettinius prestige behind it there is little doubt that the proposal will go through on a second try In any case it is a clear indication that the Defense Commission has its eye on the Tennessee Valley as a site for defense industries The Commission may also be interested in the Columbia Valley and the Grand Coulee Dam

The merry-go-round method of fabrication with gun welders is apparently already out of the picture in certain shops

G M. Diesel Division Expands

By the first of the year the Detroit Diesel Engine Division of General Motors will have in operation a new 600x280 ft addition that will double its present productive capacity of 3 000 small engines yearly The product of the Detroit plant goes to a variety of outlets and consists of one two three four and six-cylinder models ranging from 15 to 165 hp It is understood that the new addition is required solely for expanding commercial business and is not predicated upon anticipation of national-defense needs

Considerable steel tonnage has been placed for 1941 models but local vendors regard present orders as conservative Deliveries are being maintained on a ten-day to three-week basis because the mills were able to anticipate demand better than prior to the swift upsurge last fall Prices remain unchanged Apparently there is no fear that prices will be raised, or else buyers would be stampeding the market It will be remembered that the government turned thumbs down on a price increase a year ago

Auto dealers are moving present stocks with the threat of a price increase next year and manufacturers apparently condone the practice as smart merchandising But if steel does not go up and other commodity prices do not get out of line it may be argued that there will be no appreciable price advance on 1941 models At the present time auto plants anticipate a good 1941 season because of increased spending brought about by the national-defense program Competitive reasons may prevent taking advantage of the market

A.S.T.E. ADDS TWO MORE CHAPTERS

DETROIT The American Society of Tool Engineers recently started two new chapters one at Columbus Ohio and the other at Indianapolis Ind This increases the chapters to 37

Officers of the Columbus Chapter No 36 are Chairman R J Freter chief engineer Columbus Bolt Co chairman C E Nelson supervisor of tools the Jeffrey Mfg Co vice-chairman, S J Matchett Jr engineer, Ranco Inc secretary, H M Poole instructor in industrial engineering Ohio State University treasurer

The Indianapolis Chapter (No 37) elected the following Chairman H D Hiatt, Allison Engineering Co, vice-chairman Ronald Updike chief tool engineer, Schwitzer Cummins Co, secretary, R D Harris chief designer International Harvester Co, treasurer D H Chancellor Prestolite Co

WATCHING WASHINGTON

Billions voted in defense spending spree Government funds to finance new arms plants Biggest choke point is getting orders out President will give Knudsen his complete backing

BY BLAINE STUBBLEFIELD

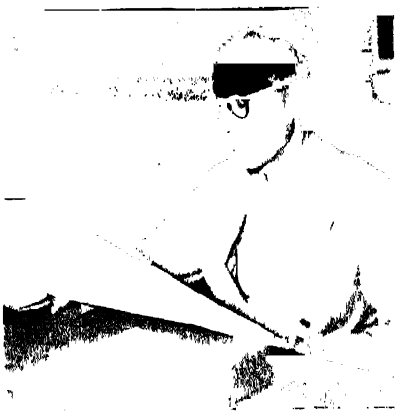
WASHINGTON—Billions are being authorized or appropriated for defense so rapidly by Congress that it makes one dizzy trying to keep up with the latest action As an example the first deficiency bill gave the Army $732 000 000 including a $200 000 000 blank check to the President The second deficiency bill provides an additional $1 030 000 000 for the War Department Now along comes Mr Roosevelt with an army program which will need an additional $1 000 000 000 to $5 000 000 000 The new billions are to be used to produce equipment for an army of 2 000 000 men just in case The Army would like to see that much equipment on hand by August 1941 but to a practical observer that date seems optimistic

Tens millions of dollars will go for construction of new munitions-making plants Where they will be located is not known but one thing is sure many of them will be in the interior In some cases factories will be financed and operated exclusively as a government venture They will produce only highly specialized war products In other cases the government will furnish the money with which to build the plant and to buy all the machinery but will turn over the operation to private manufacturers

There is still a third policy The government is permitted according to a bill just passed to advance 30 per cent on a munitions contract to enable a supplier to build additional capacity or to tool up extensively if such action is necessary and the size of the order warrants it Arrangements have been made for the RFC to loan money to suppliers but in most instances suppliers are able to secure all the finances they need from their regular banking sources The administration still hates to make any concession in quick write-offs of plant and equipment though the War Department long has wanted such provision

Capital the Choke Point

So far as choke points are concerned in the defense program various government agencies point to a number of them smokeless powder making facilities armor plate capacity big gun and small arms and ammunition production high horsepower aircraft engines trucks and tractors (including tanks) tool and die making capacity and machine tools Many of these choke points may not turn out to be choke points at all but both the Army and Navy are watching them Meanwhile the choke point at the moment is Washington itself Manufacturers cannot start tooling up for munitions manufacture until they know what they are tooling up for Some officials express the fear that the whole program may be needlessly delayed because red tape won't be cut fast enough They say that certain departments are contract conscious rather than production conscious and just can't pull themselves out of their old habits of waiting until every T is crossed and every I is dotted before placing orders In justice it should be said that Mr Knudsen's commission has moved with alacrity and has succeeded in getting many things done which normally would have taken much longer



Chief *Just in time to take the world's biggest shipbuilding job on his shoulders Rear Admiral Samuel M Robinson assumes duty as Chief of the Bureau of Ships This bureau newly created by Congress combines the functions of the Bureau of Construction & Repair and the Bureau of Engineering Admiral Robinson was born in 1882 attended the Naval Academy made a distinguished career in naval ship design It was the forward looking ex Secretary of Navy Charles Edison who pushed the reorganization through Congress This is the first change in the Navy Department since organization of the Bureau of Aeronautics in 1921*

PACKARD GETS FORD CONTRACT

WASHINGTON — The Packard Motor Co has agreed to take over the Rolls Royce engine contract which was previously to be filled by the Ford Motor Co Packard will build 3 000 engines for the United States and 6 000 for Great Britain Packard's president Gilman says production will start in ten months at 20 units a month reaching 840 a month after fifteen months

General Motors Steps Up

While Henry Ford wallows in a morass of seething criticism from the Army Navy and administration for his attitude General Motors has tepped into the defense situation in a big way Its boss Bill Knudsen heads all defense activities in Washington Its former export chief Jim Mooney has been assigned the task of expediting all defense business assigned the corporation General Motors undoubtedly is on the list to have sizable armament orders Already Chevrolet has educational orders for forging and machining shells and Saginaw Steering Gear for making Browning machine guns But those are only the beginning

Knudsen Plans Long Stay

One astute observer says National Advisory Defense Commission headquarters and set-up begin to resemble NRA and if you'd check up you would find a considerable number of NRA payrollers already holding down defense jobs Perhaps so Admittedly the President has appointed a number of New Dealers to minor capacities with Knudsen Stettinius & Co And it is known that confirmed Left Winger Leon Henderson is dabbling into defense affairs which are no concern of his (and of which his ignorance is abysmal) Nevertheless the President is giving Bill Knudsen full backing True Mr Knudsen's honeymoon period in Washington is hardly over He has taken a house on Washington's outskirts for three months already is worrying over a place to live after that time is up

U.S. Embargo on War Materials May Cut Nippon Plant Expansion

TOKYO- The curtailment and possible embargo of export shipments of machine tools and implements of war may seriously affect many Japanese industrial expansion plans according to the *Nippon Kogyo Shunbun* On the assumption that machine tools could be obtained from the U S the Niigota Iron Works one of the big six recently doubled its capitalization to $10 000 000 to obtain funds for the enlargement of its Niigota Kashuwazaki Urawa and Kamata plants Among other expansion projects which may be affected are The Ishikawajima Shipbuilding Company s aero-engine plant the Tokyo Automobile Company the International Industrial Company and the Manchu Aircraft Company s aeronautical plants and the Manchu Automobile Company It is partly due to the events in Europe that these companies have all come to depend upon imports from the U S

Machine Tools Vital

The Shibaura-United Industrial Company in which General Electric and United Engineering & Foundry have an interest may not be in a position to continue its plans for large-scale production of rolling mills should additional tool orders from the U S be embargoed

In Tokyo the Army and Navy Planning Board and the Commerce-Industry Ministry are reported to have decided on joint action to reorganize the home machine tool industry on a new basis in the event that a total embargo on machine tool exports from the U S materializes A complete socialization of the Japanese machine tool industry may be effected Japanese law provides for the expropriation of foreign patents in case their exploitation in Japan is deemed necessary for national defense



Vanishing Market—*Japanese machinery imports aren't what they used to be but what business there is U S manufacturers have lately had to themselves Note a machine tool embargo may seriously curtail Japanese plant expansion typified by the installation of this 900 ton forging press*

$100,000,000 ARMS EXPORTED

WASHINGTON—From the State Department comes the announcement that a total of $100,063 - 870 68 worth of arms ammunition and implements of war have been exported from the United States during the year 1940, including May The largest buyer of war materials was France with $53 712 110 50 Great Britain was second with $13 335 081 15, Australia was third with $8,472,739 62 Other heavy buyers were Finland $5 096 837, Canada $2 657 - 524 China $2 421 758, Netherlands East Indies $2 349 644 and Turkey $1 705 800

Marked Expansion of Shipyards On Government Defense Program

WASHINGTON—Expansion of shipyards will be the next big thing on the defense program Admiral Emory S Land has been appointed coordinator of shipbuilding for the Defense Commission in preparation for large-scale construction of yards and ways and rehabilitation of old ones, $150 000,000 has been appropriated for this purpose

The Maritime Commission says 24 yards are building ocean-going vessels About 18 have contracts for Navy or Commission ships Many of these jobs are contracted up to capacity It is estimated there are 60 ways that would take combatant vessels while Navy has money to build 140 ships right away Ten battleships and five carriers are scheduled for immediate building but experts believe that existing facilities will handle only twelve of the fifteen Space is available for only seventeen light cruisers whereas funds are provided for twenty-five There are other serious shortages of building space On top of the Navy program, the largest ship construction job in history is the Merchant Marine schedule of 50 ships a year for ten years

U. S. Government Defense Contracts Awarded to Metal Working Firms

Other Metal Working Contracts on Page 17f

Contractor	Govt Agency	Commodity	
Baldwin Locomotive Works Eddystone Pa	Ordnance	Shell forgings	$240 72
Gilbert & Barker Mfg Co Springfield Mass	Ordnance	Rifle parts	23 701
Tennessee Coal Iron & Railroad Co Birmingham Ala	Ordnance	Shell forgings	133 759
Stockham Pipe Fittings Co Birmingham Ala	Ordnance	Machined shells	69 9 7
Wieland Co Chattanooga Tenn	Ordnance	Machined shells	66 758
Standard Drawn Steel Co Jenkintown Pa	Ordnance	Primer heads bullet cores	320 60
Consolidated Steel Corp Los Angeles Calif	Ordnance	Demolition bombs	109 826
Omaha Steel Works Omaha Neb	Ordnance	Machined shells	161 658
Colorado Fuel & Iron Corp Denver Colo	Ordnance	Shell forgings	51 674
Key Co East St Louis Ill	Ordnance	Machined shells	164 203
W C Norris Mfgr Inc Tulsa Okla	Ordnance	Machined shells	76 689
Chrysler Corp Detroit Mich	Ordnance	Cartridge cases	154 082
Bendix Products Div Bendix Aviation Corp South Bend Ind	Navy	Airplane parts	11 458
United Aircraft Corp Hamilton Standard Propellers Div East Hartford Conn	Navy	Speed control units	17 940
Precision Mfg Co Philadelphia Pa	Ordnance	Telescope mounts	68 120
Sperry Gyroscope Co Brooklyn N Y	Ordnance	Computing sights	25 000
Bausch & Lomb Optical Co Rochester N Y	Ordnance	Stereoscopic trainers	15 227
Stanley G Flagg & Co Philadelphia Pa	Navy	Tube fittings	40 222
Walworth Co New York N Y	Navy	Tube fittings	103 474
Kingston Products Corp Kokomo Ind	Ordnance	Machined shells	45 062
Darling Valve & Mfg Co Williamsport Pa	Ordnance	Machined shells	58 902
Meigenthaler Linotype Co Brooklyn N Y	Ordnance	Aiming circles	128 953
Mattatuck Mfg Co Waterbury Conn	Ordnance	Primer bodies	18 000
Chicago Screw Co Chicago Ill	Ordnance	Cartridge containers	10 098
Dictaphone Corp Bridgeport Conn	Signal Corps	Code transmitter	14 250
Grumman Aircraft Engineering Corp Bethpage N Y	Navy	Aircraft axles	15 882
Curtiss Wright Corp Curtiss Aeroplane Div Buffalo N Y	Navy	Airplane parts	12 311
Douglas Aircraft Co Santa Monica Calif	Air Corps Navy	Gun sights plane parts	127 213
Pioneer Instrument Div Bendix Aviation Corp Bendix N J	Navy	Aircraft instruments	9 800
Spencer Lens Co Buffalo N Y	Navy	Telescopic alidades	40 496
U S Machine Corp Lebanon Ind	Ordnance	Machined shells	35 155
Chevrolet Motor Div General Motors Corp Detroit Mich	Ordnance	Machined shells forgings	136 977
Federal Screw Works Chelsea Mich	Ordnance	Detonator sockets	86 870
General Iron Works Co Denver Colo	Ordnance	Machined shells	115 455
National Pneumatic Co Rahway N J	Ordnance	Guns	1 412 227
Hobart Mfg Co Troy Ohio	Ordnance	Telescope mounts	46 099
General Electric Co Schenectady N Y	Ordnance	Howitzers	152 834
Midvale Co Philadelphia Pa	Ordnance	Gun barrels	428 736
Scovill Mfg Co Waterbury Conn	Ordnance	Cartridge cups	43 450
American Brass Co Torrington Conn	Ordnance	Cartridge cups	79 400
Eastman Kodak Co Rochester N Y	Ordnance War	Telescopes aiming circles	138 977

NAMES in the NEWS

U. S. Steel Chairman

Irving S Olds has been elected chairman of the United States Steel Corp, Pittsburgh Pa He succeeds Edward R Stettinius Jr, who has resigned to serve as a member of the recently appointed National Defense Commission

A director and a member of the Finance Committee of U S Steel since 1936, Mr Olds was born in Erie Pa in 1887 He graduated from Yale in 1907 and from Harvard Law School in 1910 and was admitted to the bar in Pennsylvania in 1910 and in New York in 1912 He was secretary to Mr Justice Holmes of the United States Supreme Court from 1910 to 1911 becoming connected with White & Case of New York in 1911 admitted as a partner in 1917 For the next two years Mr Olds served as counsel for the purchasing department of the British War Mission to the United States, and in 1918 was a special assistant in the U S War Department Since 1919 he has been engaged in legal work related to matters of organization and administration of corporate business enterprises

Robert Urquhart since 1914 employed at the Homestead steel works of Carnegie-Illinois Steel Corp Pittsburgh Pa has been appointed assistant general superintendent in charge of operations He is succeeded by Walter F Nicoden as superintendent of open hearth departments Warren W Scherer has been appointed superintendent of maintenance and Fred C Frame has been named to Mr Scherer's former position as superintendent of industrial relations at the company's Irvin works

Andrew Heilman has been named president and manager of Tiffin Gray Iron & Semi-Steel Co Tiffin Ohio

Advancing, Retiring, in Canton Roll & Machine



IRVING S OLDS



HAROLD P INGRAM



WILLIAM A HARRIS

Harold P Ingram has been appointed general superintendent of the Canton Roll & Machine Works Canton Ohio according to an announcement by Carnegie-Illinois Steel Corp He succeeds William A Harris who is retiring after 34 years of continuous service with subsidiary companies of United States Steel Corp

Mr Ingram was born at Homestead Pa in 1898 He attended Carnegie Institute of Technology and began his industrial career in the engineering department of Westinghouse Electric & Mfg Co at East Pittsburgh in 1919 Two years later he entered the roll department of Homestead works as an apprentice and from 1920 until 1928 was employed as a draftsman From that time until 1937 he was superintendent of the Homestead roll department He has been superintendent of maintenance at Homestead works since 1938

Mr Harris was born in Niles Ohio in 1871 and received a degree in mechanical engineering from Cornell University in 1893 He entered the sheet steel industry that year and became associated with U S Steel subsidiaries at the American Tin Plate as assistant chief engineer in 1900 From 1902 until 1906 he was secretary and chief engineer of Lewis Foundry & Machine Co at which time he went to Canton as manager of the Roll & Machine Works for American Sheet & Tin Plate Co Upon merger of the sheet and tin plate company with Carnegie-Illinois in 1936 Mr Harris became works general superintendent

Courtlandt S Gross has been elected president of Vega Airplane Co Burbank Calif subsidiary of Lockheed Aircraft Corp He succeeds Mac Short who has been named vice-president in charge of engineering

George M Hunter vice-president in charge of manufacturing operations for American Bridge Co Pittsburgh Pa has retired with a service record of 51 years with the company Frank K McDanel associated with the organization since 1904 succeeds Mr Hunter

Harry K Clark has been elected vice-president and general manager, and Andrew B Holmstrom has been named vice-president and works manager of the Norton Co Worcester Mass

These appointments fill vacancies caused by two resignations Aldus C Higgins president who also held the office of general manager has resigned the general managership and George N Jeppson, treasurer and vice-president who also held the position of works manager has resigned as works manager Mr Higgins will continue as president, and Mr Jeppson will retain the offices of treasurer and vice-president

Mr Clark has been with Norton for 25 years having served as salesman Chicago district manager sales manager of the company's plant in Germany, sales manager of the Abrasive Div general sales manager a director and vice-president He is also executive officer in charge of Norton Co of Canada Ltd a director of

Promoted by Norton



ANDREW B HOLMSTROM



HARRY K CLARK

Behr-Manning Corp., and a director of Australian Abrasives (Pty.) Ltd.

Mr. Holmstrom has been connected with the company for twenty years, having had considerable experience as an engineer and in plant management. After five years in the Norton plants engineering department, from 1920 to 1925, he was appointed superintendent of sewers of the city of Worcester, when the city was installing a large sewage purification plant When the plant was completed he returned to Norton, later going to England as resident engineer of the Norton Grinding Wheel Co., Ltd. Two years later he returned to Worcester, but in 1934 went back to England as general manager of the British plant. He again returned to America in 1939 to become works manager of the Abrasive Div.

August H. Tuechter, president Cincinnati Bickford Tool Co., Cincinnati, Ohio, will complete 55 years of service with the company July 13.

PLANT EXPANSION

George H. Alexander Machinery Ltd., Birmingham, England, in conjunction with McKenna Metals Co., Latrobe, Pa., has organized Kennametal of Canada, Ltd., for manufacturing Kennametal for Canada and the British Dominions. The main office and factory will be in Hamilton, Ont. Philip M. McKenna is president of the firm, and Arthur H. Alexander of Victoria, British Columbia, has been named general manager.

The Bullard Co., Bridgeport, Conn., has embarked upon its second important expansion move within a month. Contract has been awarded to Turner Construction Co. for erection of a 175x100-ft. machine shop.

Green Bay Drop Forge Co., Green Bay, Wis., is planning erection of a $4,000 steel treating plant.

Vultee Aircraft, Inc., Downey, Calif., is embarking upon a plant expansion program which will involve nearly $3,000,000.

Waterbury Tool Co., Waterbury, Conn., has awarded contract to the Austin Co. for an addition which will add 23,000 sq.ft. of manufacturing space. In the future the company will be known as the Waterbury Tool Div. of Vickers, Inc., of Detroit, Mich. The Detroit parent company is also building an addition which will cost approximately $500,000.

H. G. Weber Co., Kiel, Wis., paper bag machinery maker, is erecting a new plant addition.

OBITUARIES

Louis E. Murphy, formerly president and chairman of E. F. Houghton & Co., Philadelphia, Pa., died June 26 at his summer home at Mantalocking, N. J., following a short illness culminated by double pneumonia. He was 66 years of age.

Mr Murphy had been connected with the Houghton organization for

Former Houghton Head Passes



LOUIS E. MURPHY

52 years, having started as an errand boy in 1888 He was elected secretary of the company in 1910 and vice-president in 1914. He became president in 1929, and chairman in 1934. After his resignation in 1936 he continued as a director up to the time of his death.

Walter C. Doering, 53, vice-president American Steel Foundries and former vice-president of Bradford Corp., railroad equipment manufacturer, died June 21 in St. Louis, Mo.

Daniel W. Hobbs, 87, former superintendent at the Yates-American Machine Co., Beloit, Wis., died May 30.

Harold G. Pederson, 46, president Pederson Tool & Cutter Co., Milwaukee, Wis., and widely known as the inventor of Pedwyn balancers, died in that city June 16.

John Prentice, 67, superintendent of the Bayone, N. J., plant of Babcock & Wilcox Co., New York, N. Y., died June 30 following a short illness. He had been with the company since 1898.

Edward R. Sargent, 84, former director and official of Sargent & Co., New Haven, Conn., died suddenly June 20.

Jeremiah F. Shea, 53, for fifteen years president Shea Foundry & Machine Co., Bridgeport, Conn., died June 26.

John P. Togstad, 58, superintendent Ben H. Anderson Mfg. Co., Madison, Wis., died June 12.

BUSINESS ITEMS

Allegheny Ludlum Steel Corp., Pittsburgh, Pa., has appointed Murray-Baker-Frederic, Inc., New Orleans, La., as distributor for its line of tool steels.

Belmont Radio Corp., Chicago, Ill., has purchased one unit of the former Grigsby-Grunow Co. plant in that city.

Louis E. Emerman & Co., Chicago, Ill., used machine tool dealer, has purchased Davis - Thompson Co., Milwaukee, Wis., manufacturer of automatic production machinery. Operations will be continued in Milwaukee under the same corporate name with new owners of the firm producing machine tools for the automotive industry under patents owned by Frank M. Davis. The plant will be in charge of William H. Weimer, with the company since 1911, who will serve as vice-president and general manager. C. L. Nelson will be president, and Mr. Davis will become chairman of the board.

Manning, Maxwell & Moore, Inc., Bridgeport, Conn., has changed the name of its Ashcroft American Gauge Division to Ashcroft Gauge Division.

Thomas C. Wilson, Inc., Long Island City, N. Y., has moved its offices and factory to larger quarters at 47-28 37th St.

MEETINGS

American Institute of Electrical Engineers Pacific Coast convention, Los Angeles, Calif., Aug. 26–30.

National Foreign Trade Council. Twenty-seventh national foreign trade convention, San Francisco, Calif., July 29-31.

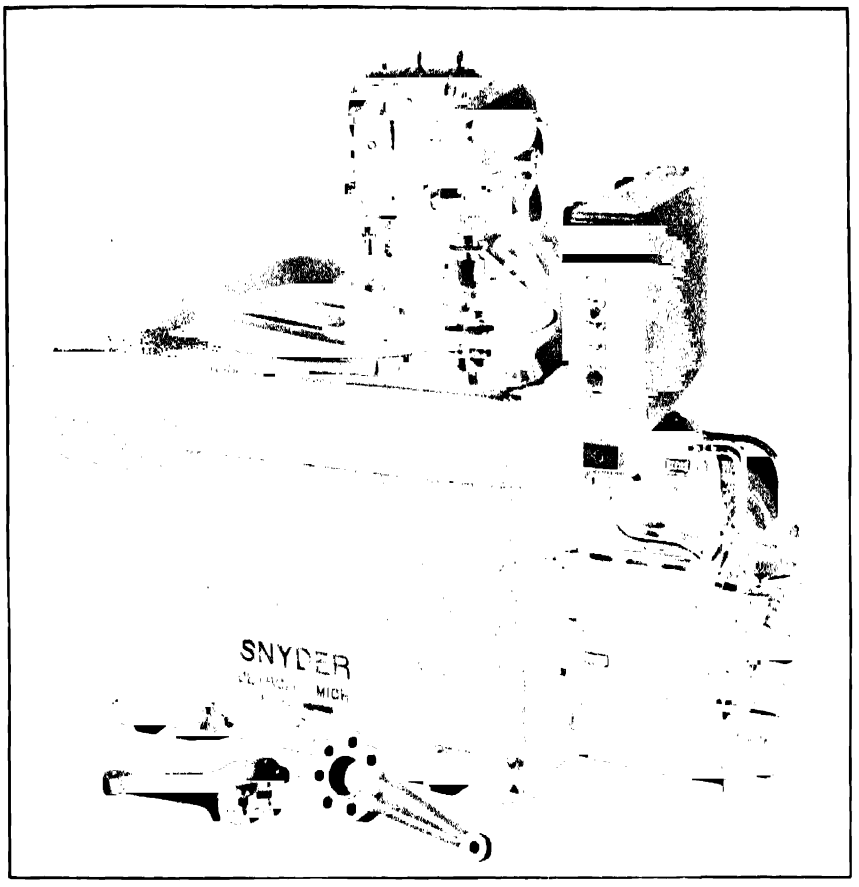
Porcelain Enamel Institute. Fifth annual forum, University of Illinois, Urbana, Ill., Oct. 16–18.

Silver Bay Conference on Industrial Relations. Twenty-third annual meeting, Silver Bay on Lake George, N. Y., July 24–27.

Society of Automotive Engineers. National tractor meeting, Schroeder Hotel, Milwaukee, Wis., Sept. 24 and 25. Annual dinner, Hotel Commodore, New York, N. Y., Oct. 14.

SHOP EQUIPMENT NEWS

Special Snyder Contour Milling Machine Developed for Finishing Master Rods



High nickel-chrome master rods for a foreign aircraft engine will be contour milled complete in 30 min. on a special contour miller built by the Snyder Tool & Engineering Co., 3400 East Lafayette St., Detroit, Mich. The machine also is suitable for articulated rods and other contour milling operations of similar nature by merely changing the master cam located below the work-table fixture plate. The heat-treated master rod is located on the fixture from two drilled holes in the large and small bosses. After pressing a button, an automatic cycle involving four distinct work movements is secured. The contour of the rod is completed with all cuts blended together.

In the first position of the work table and work slide, the center of the small boss lies on the center of work table rotation. The cutter head is fed to depth hydraulically, after which the work table rotates at the proper feed through an arc of 142 deg.

At the second position work rotation is stopped, and the slide moves to the right to mill one side of the rod. The slide is moved by an hydraulic cylinder operating under pressure of 1,800 lb. per sq.in. The cutter head is being urged toward the work by a 300 lb. per sq.in. circuit so that its roller is pressed firmly against the master cam. Thus, when the more powerful slide moves the master cam past the cutter head roller, the cutter head advances or retreats with the master cam cutline.

At the third position the slide has moved so that the center of the large boss coincides with the center of the work table. Point slide movement is arrested and the work table is revolved 218 deg. The fourth position is reached, the work table rotation is stopped, the slide again moves to the right to mill the opposite side of the rod, finally finishing at the original starting point.

Slide movement and work table rotation are cut on and off as required by limit switches fixed to the periphery of the work table. These switches can be adjusted so that there is no overlap or gap in the respective motions, resulting in blended cuts. The work table is driven by a double worm and wheel arrangement that eliminates any tendency toward backlash.

Pratt & Whitney Grinder Made for Deep Hole Drills

A machine for sharpening deep hole drill tips has been developed by Pratt & Whitney Div., Niles-Bement-Pond Co., West Hartford, Conn. This compact deep hole drill sharpener will take drills from 3/16 to ⅝ in. diameter inclusive. The roughing, finishing, and general purpose grinding wheels all are driven directly by a 1/3 hp. motor. The coolant system consists of a pump and 1/6 hp. motor mounted at the rear of the pedestal, suitable piping for all wheels, and a coolant reservoir inside the pedestal with provision for removing sediment and draining.

The drill to be sharpened is inserted in a drill bushing and cam mounted on the rocker. Four removable bushings and cams of different sizes and pitches are furnished with the machine. The surface on the face of the cam contacts a cam abutment to



produce the correct helix and dwell positions. An adjusting nut at the front of the rocker feeds the entire rocker unit on a threaded shaft toward or away from the grinding wheel. This shaft is fastened to the elevating shaft, which provides vertical adjustment through a nut to obtain the desired relief at the cutting edge.

The rocker housing contains a worm shaft which, when rotated, swings the entire unit around a gear on the threaded rocker shaft. This furnishes

the means for moving from the roughing to the finishing wheel, and also acts as a sidewise feed while sharpening. The diamond for dressing the roughing and finishing wheels is mounted on the rocker. The entire rocker unit can be swiveled about the elevating shaft and bound in the desired position.

Provisions for step grinding are available, although it may require a slightly harder grinding wheel. Stepping the drill splits the chips and facilitates their passage through the chip groove in the shank of the drill. It also tends to make smoother holes and increases the life of the drill between sharpenings.

Oilgear Propeller Twisting Machine Corrects Inaccuracies in Pitch

The improved fluid power, variable speed propeller twisting machine manufactured by the Oilgear Co., 1302-A W. Bruce St., Milwaukee, Wis., is adapted for twisting 7 to 14 in. wide airplane propeller blades to correct inaccuracies in pitch It permits the blades to be forged very nearly to the finished size so that only a small amount of stock need be removed during the machining operation. It will maintain the axis of the twist upon the longitudinal center line of the work piece. The machine, shown in Fig. 1, may be adjusted to make twists between various lengths, and will operate in either direction to increase or decrease pitch of a blade.

A simple pushbutton control of the hydraulic clamp is provided in the stationary and twisting supports. A hand lever with pilot follow-up control of the speed and direction of the twisting support movement. A Type DH-411 oil gear two-way variable displacement radial piston pump provides power necessary for both the clamping and twisting movement. Stationary and twisting clamp supports, Fig. 2, have integral clamping and unclamping cylinders. Fully-inclosed equalizer assemblies support twister clamp support and restrain side movement.

The propeller blade is loaded from the back of the machine and threaded through stationary clamp and twister clamp to the point to be twisted. The operator then depresses the pushbutton control and the stationary clamp closes on propeller blade under low pressure. If the blade is in the proper position, the operator depresses the other pushbutton and the twister clamp closes under low pressure. If the propeller is to be twisted clockwise, the hand lever is moved to the right. If the hand lever is moved to the left the blade is twisted counterclockwise. Pressure on the stationary and twister clamp automatically increases in direct proportion to the increase in pressure required to twist the blade. When the proper twist has been imparted, the pushbutton control again is operated to open the clamp.

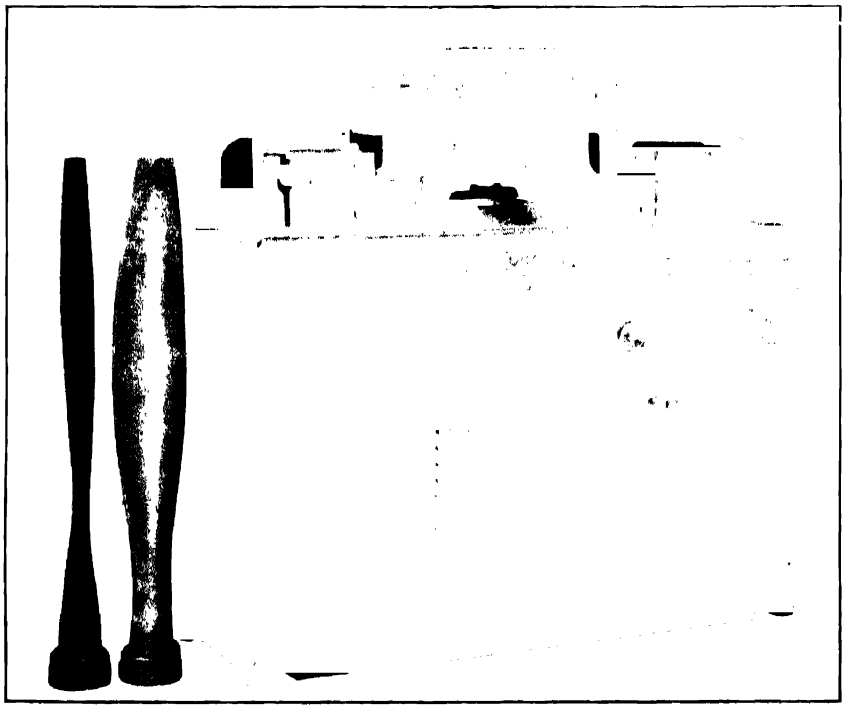


Fig. 1—Airplane propeller blades from 7 to 14 in. wide can be twisted in this machine to correct inaccuracies in pitch. The axis of twist is maintained on the longitudinal center line of the work



Fig. 2—Two pushbuttons and hand lever control all movements of this propeller twisting machine. All movements and clamps are operated hydraulically

When the hand lever is released the twister support automatically returns to a preset horizontal position on the same axis as the stationary clamp support. The propeller can be moved inward or outward to perform twisting operations on other sections of the blade. The center distance between stationary and twisting clamp can be varied from 7 to 10 in. so as to vary the length of twist.

This machine has a normal torque of 530,000 in. lb. and provides a twisting movement of 24 deg. (12 deg. either side). Height of work clamps above the floor is 56 in. Floor space required is 81 in. from right to left and 29 in. from front to back. The machine is 75 in. high.

Thomson Welding Press Is Widely Adaptable

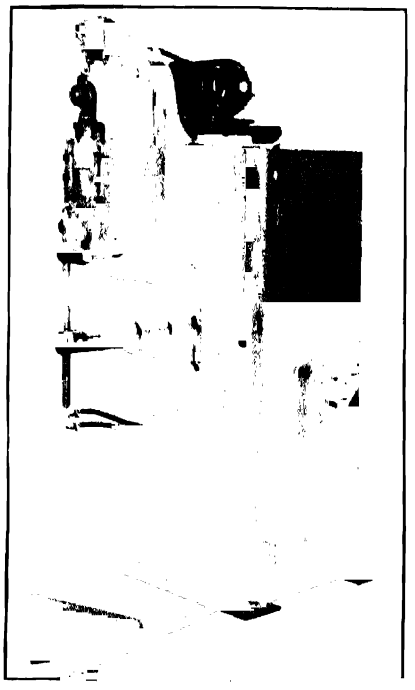
The interchangeability of essential parts on the 1940 Model No. 1 welding press offered by Thomson-Gibb Electric Welding Co., 164 Pleasant St., Lynn, Mass., makes it possible at any time to remodel the machine to suit new requirements with a minimum of labor and expense. For example, the machine may be purchased with a standard spring pressure head and then quickly converted to an air lock head type, or a machine with an apron mounted lower arm can readily be changed to a column mounted type or to a knee type machine for projection welding.

The fabricated steel frame is reinforced to minimize deflections under maximum loads prescribed by the Resistance Welder Manufacturers Ass'n. The transformer is completely inclosed and protected. Except for essential controls which are conveniently located, the sides of the frame are smooth. The flat sliding head moves with straight line action in

adjustable gibbed ways Peel-off shims provide adjustment for wear All bearing surfaces are lubricated by grease fittings located in plain view of he operator

Sliding head is actuated by a special cam designed to slow down the electrode as it approaches the work and so minimize electrode hammering This cam action is said to be preferable to a toggle mechanism since it involves fewer moving parts and because electrode contact is less severe The head is returned by two compression springs which are concealed inside the neck

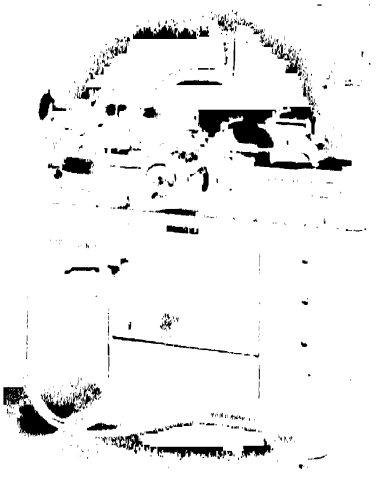
A combination worm reduction and clutch unit running in an oil bath is



featured on this line of presses Standard equipment includes a reliable limit switch for initiating current flow This switch is closed and opened by accurately adjustable multi-leaf fan cams which can be used to time the welds directly to a contactor or through an auxiliary timing device A variable speed pulley driven by a ¼ hp motor provides infinite speed selection between standard ranges of 36 to 109 or 44 to 133 strokes per minute The press is designed to operate at electrode pressures up to 1 000 lb This applies to units with 12 18 24 or 30-in standard throat depths Transformer ratings are 30 40 50 and 75 kva

South Bend 10-In. Lathe Has 1-in. Collet Capacity

The Series S toolroom bench lathe announced by the South Bend Lathe Works, 425 F Madison St South Bend Ind is recommended for precision operations on small work This 10-in swing lathe has a 1-in maximum collet capacity When mounted on the welded steel bench shown the lathe is claimed to have the stability of a floor type lathe Handwheels have been made large so as to reduce operator fatigue Smooth operation at high



spindle speeds is achieved by using a direct belt drive to the balanced cone pulley and spindle assembly Back gears provide slow spindle speeds with ample power for machining

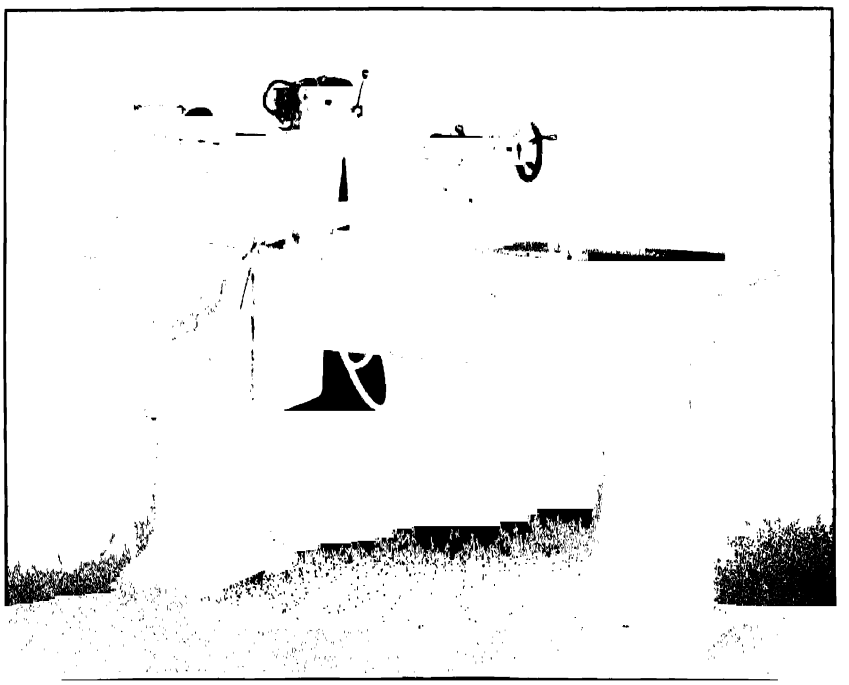
The headstock has 1⅝-in capacity through the spindle and can be equipped with either hand lever or handwheel type draw-in collet chuck Twelve spindle speeds ranging from 50 to 1,357 r p m are provided by the standard motor drive equipment Special drives are available where higher spindle speeds are necessary A quick change gear mechanism provides power longitudinal carriage feeds from 0 0015 to 0 0836 in power cross feeds from 0 0006 to 0 0313 in and a series of 48 right and left-hand screw threads from 4 to 224 per inch

Power carriage feeds are operated by a worm drive and a series of precision cut steel gears in the apron which run in a bath of oil The power feeds are controlled by a multiple disk friction clutch which may be engaged or disengaged quickly The carriage is equipped with a graduated compound rest which may be swiveled to any angle and locked for turning or boring bevels and tapers This lathe is made in 3 3½ 4 and 4½ ft bed lengths providing up to 34⅝ in between centers A telescopic taper attachment included as standard equipment makes it possible to change quickly from straight to taper turning or boring without disengaging the cross feed nut

Ohio Units Superfinishing Machines Designed for General Shop Use

Designed to take care of almost any type of surface to which superfinish can be applied a superfinisher suitable for general shop use has been made available by Ohio Units 515-531 Hunter Ave Dayton Ohio It is suitable for use in toolrooms experimental departments and for small production runs Round and flat external and internal surfaces can be superfinished on this machine

The No N-301 universal superfinisher shown has an oscillating head which carries the superfinishing stones This head is mounted on a carriage which may be manually traversed to permit the stones to come in contact with the full length of the



work. The head may be adjusted quickly to any position required, depending on the size of the work, and is driven by a flexible shaft from the main motor. Tension of the stones against the work is controlled through a spring adjusting device which may be changed instantly.

A gear type pump with a capacity of 1½ gal. per min. is mounted in the base, together with its driving motor. From this pump a steady stream of lubricant is delivered to the work through a flexible tube connection. The pump is equipped with an internal release valve so that the flow may be adjusted to any capacity desired. Suitable fittings are supplied for connecting to stone holders.

Capacity of the machine shown is 14 in. swing over the bed with 11 5/16 in. swing over the carriage. A raising block is available for the headstock and the tailstock, increasing these capacities to 17⅞ in. swing over the bed and 15½ in. swing over the carriage. The tailstock center has a travel of 4¾ in. Length between centers is 14 in. on the standard machine. This can be increased to 63 in. on special order. The carriage is arranged for manual traverse through a rack and pinion drive. It has an adjustable stop which may be set to limit the travel and prevent the stones striking shoulders or flanges on the work. Over-all dimensions of the standard machine are 22 x 78 x 56 in. high.

Baldwin-Omes Shell Forging Presses Combine Mechanical Piercing and Drawing

Manufactured in the United States by Baldwin-Southwark Div., the Baldwin Locomotive Works, Philadelphia, Pa., under exclusive license from Omes-Continental, Holland, Baldwin-Omes shell forging presses are available in three sizes for shell forgings from 40 to 180 mm. The machines are compact and can readily be converted to standard universal forging machines when desired.

In the operation of these machines a heated square-section billet is inserted into the opened split die. This billet rests on a lower surface of the die, which is closed by compressed air under pedal control. After the die is closed a piercing mandrel operated from the crankshaft enters the hot square section billet and expands the material towards the walls of the die. When the die is opened the pierced shell forgings fall clear.

For shell forgings up to 125 mm. the drawing machine is built on and combined with the piercing machine, whereas in the case of larger shells, for reasons of greater efficiency, the drawing machine is separated from the piercing machine. After the drawing operation the shell forging is complete with inside finish bore requiring no internal machining and with a minimum machining allowance on the outside.

In order to increase the capacity of these smaller machines a number of piercing mandrels and dies and drawing mandrels are provided so that the piercing mandrel and drawing mandrel can be used in rotation. This reduces wear and gives the mandrel time to cool, thus prolonging the life of the tools and dies.

Design of these units is different from that of the conventional type of horizontal forging and upsetting machine, in that a horizontal throwing

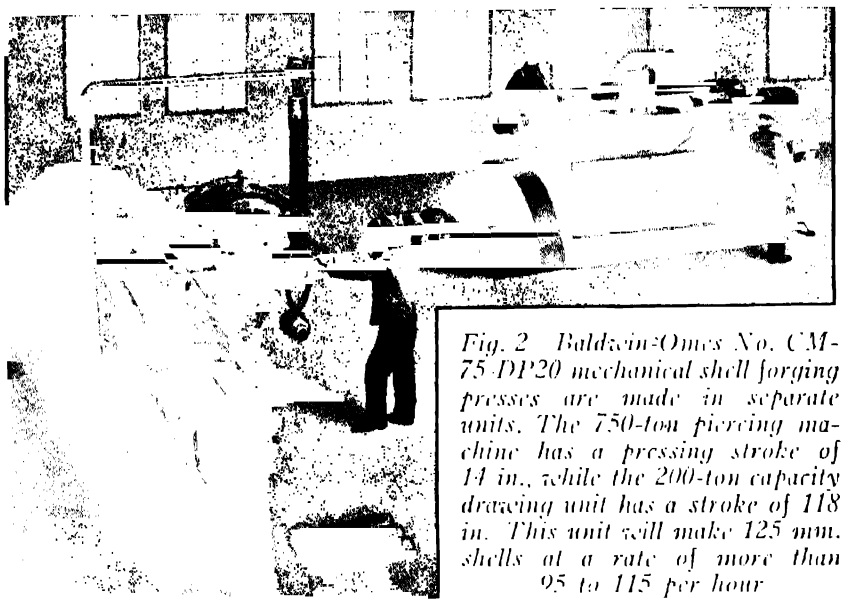


Fig. 2 Baldwin-Omes No. CM-75-DP20 mechanical shell forging presses are made in separate units. The 750-ton piercing machine has a pressing stroke of 14 in., while the 200-ton capacity drawing unit has a stroke of 118 in. This unit will make 125 mm. shells at a rate of more than 95 to 115 per hour

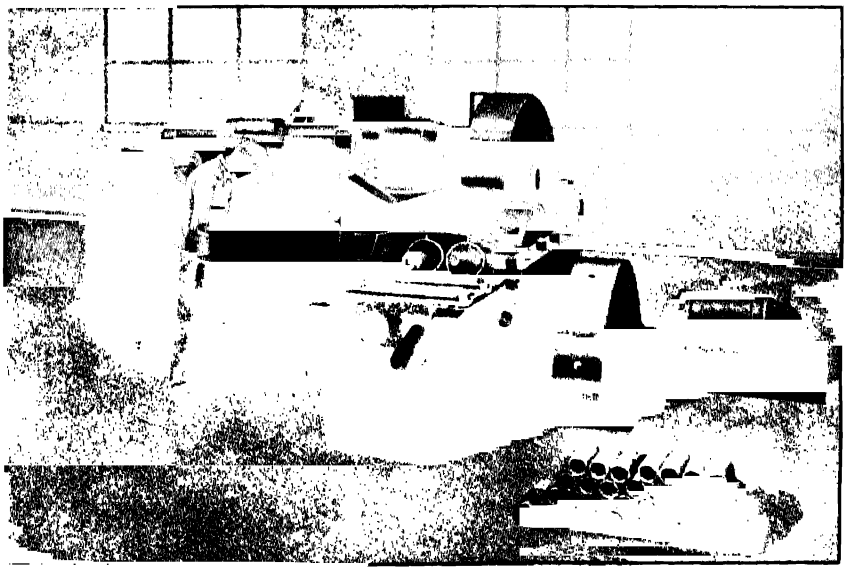
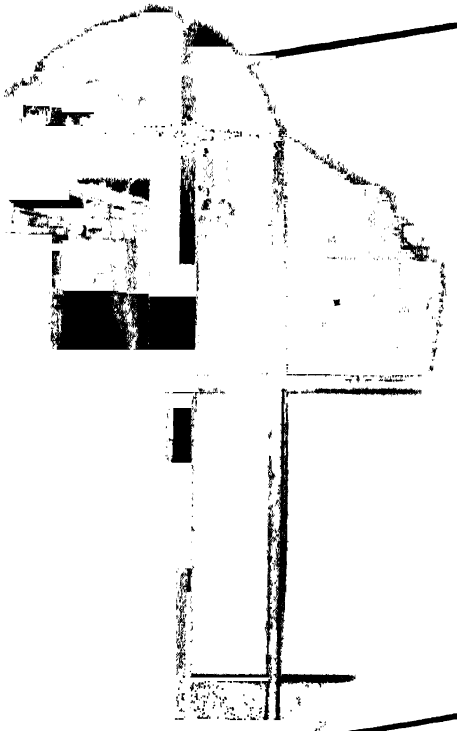


Fig. 1—The No. CM-50 unit combines a 500-ton piercing machine and a 200-ton drawing machine. Made by Baldwin-Southwark, these machines readily can be converted to standard universal forging machines

machine is coupled to the crankshaft and is operated simultaneously with the piercing part of the machine.

Since the dies, when closed, are circular, the use of a square billet means that the billet is squeezed at its four beveled corners when the jaws close. In the die there is a bushing of high grade steel which guides the mandrel, and since only linear motion takes place the mandrel enters the square section billet center, thus producing a concentric shell. When the machines are used for forging, the drawing unit is merely uncoupled from the crank pin of the driving wheel.

The smaller No. CM-35 unit is used for the manufacture of shells ranging in size from 40 to about 75 mm. Fitted with three piercing and three drawing mandrels, it requires an 85 hp. motor. The No. CM-50 unit shown in Fig. 1 manufactures shell forgings from 75 to 125 mm. (3 to 5 in.). Like the CM-35 unit, it combines a piercing machine and a drawing machine. The CM-50 machine has a pressing stroke of 14



To Assure PRECISION GEARS . . .

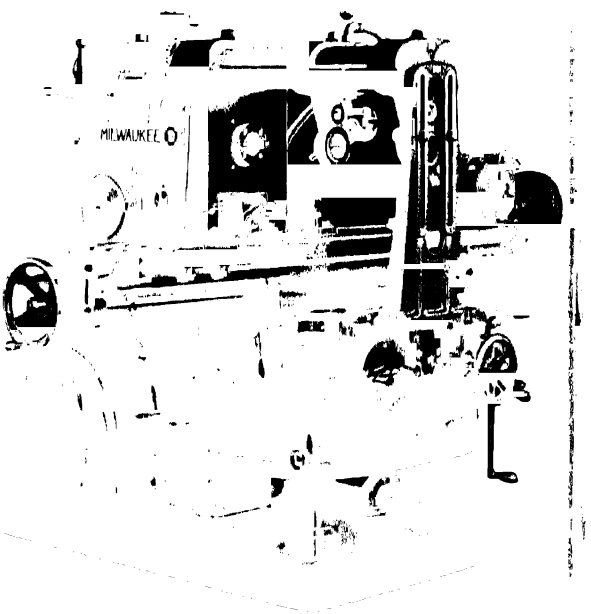
for MILWAUKEE MILLING MACHINES . . . TWO COMPLETELY EQUIPPED GEAR LABORATORIES

PRECISION gears are vital to the sustained accuracy and performance of milling machines. Cut to exacting tolerances by the finest and most complete equipment obtainable, gears for Milwaukee Milling Machines must, in addition, pass precision tests for profile, lead, bearing, involute, runout, radial and silent operation. Two completely equipped gear testing laboratories are synchronized with production operations to guarantee the fullest measure of accuracy.

KEARNEY & TRECKER CORPORATION
MILWAUKEE, WISCONSIN



Gear laboratories and three of many precision tests in the production of gears for Milwaukee Milling Machines.





KER

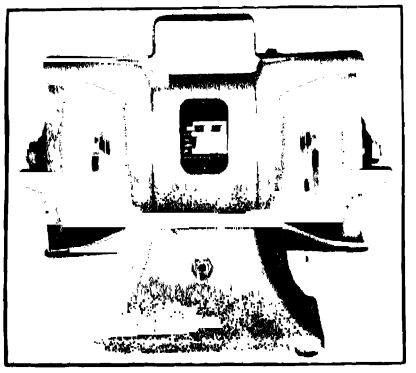
Milwaukee MILLING MACHINES

in. with a capacity of 500 tons, and a drawing stroke of approximately 60 in with a capacity of 200 tons. It requires a 120 hp. motor.

Fig. 2 shows the large No PM-75-DP20 unit for shell forgings from 125 to 180 mm. This machine is composed of a large piercing unit and a separately arranged drawing machine The former has a rating of 750 tons and a maximum pressing stroke of 14 in. The latter is rated at 200 tons and has a maximum drawing stroke of 118 in. The piercing machine requires a motor of 150 hp., while the 120 hp. motor is used for the drawing machine. It is claimed that 40 mm. shells can be produced at a rate of more than 200-250 per hr., while 150 mm. shells are produced at a rate of more than 60-70 per hr. Wall thicknesses of shell forgings produced in these machines are said to be uniform, reducing outside machining to a minimum. Reject percentages are held to a low level.

Baldor Bench Grinder Has Capacitor Motor

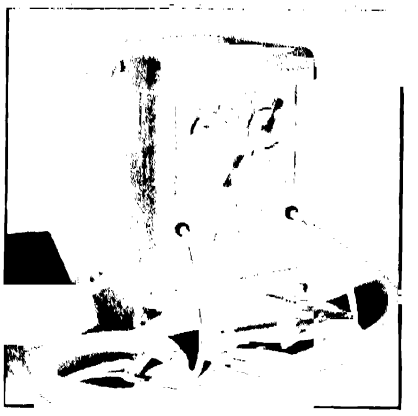
The Baldor Electric Co., 4357 Duncan Ave., St. Louis, Mo., has announced development of a ball bearing bench grinder which uses 6 x ¾ in. wheels This grinder is powered with a capacitor motor which can be overloaded repeatedly without burning out Base,



guards and tool rests on this grinder are made of cast iron. The tool rests are adjustable to and from the wheel. They also may be tiled for angle grinding. The motor is rated at ½ hp., 110 volts, single phase, 60 cycles. This grinder weighs 36 lb.

Bear Multiple Coil Welder Has Reactance Control

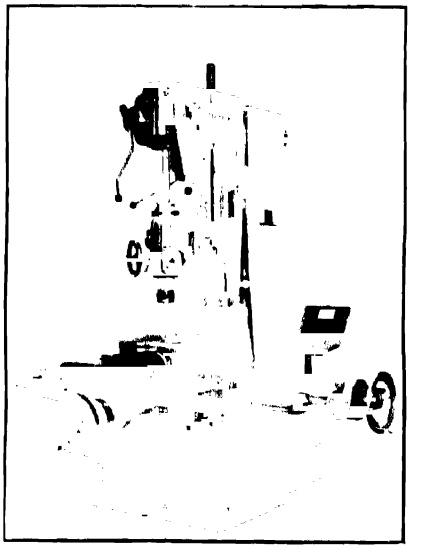
The "Arcmaster" a.c. welder offered by the Bear Mfg. Co., Rock Island Ill., has a multiple coil transformer that is said to assure an even flow of current to the electrode. It is claimed by the manufacturer that the four coil transformer construction with reactance control not only levels the peaks and valleys of power variation, to provide a smooth flow of current to the electrode, but makes possible a uni-



form and constant welding voltage with calibrated amperage. The welder case is made of cast aluminum for rapid dissipation of heat. The unit is furnished in three models with ranges of 10-200, 10-250 and 10-300 amp. All models have 220 volt, 60 cycle wattage. Each unit is provided with a ground cable and an electrode cable.

Cleereman Jig Borers Have Power Rapid Traverse

Cleereman jig borers manufactured by Cleereman Machine Tool Co. and sold through its sales division, Bryant Machinery & Engineering Co., 400 W. Madison St., Chicago, Ill., now are available with power rapid traverse for the table and carriage This consists essentially of a built-in motor which drives the screw through worm gearing, a small reversing drum switch used in conjunction with a magnetic reversing controller. Power rapid trav-



erse is available for either the longitudinal travel only, or for both the longitudinal and transverse travel.

A two jaw positive clutch is employed for engaging either the hand traverse hand wheel or the power rapid traverse worm gear. When power rapid traverse is engaged, the hand wheel is disengaged and does not rotate. The fine feed hand wheel is located on the end of the vertical motor shaft and utilizes the same worm and gear as the power rapid traverse. Limit switches are provided at each end of the travel to prevent accidental overtravel.

Motor Torch Announces Portable Cutting Machine

The Motor Torch Mfg. Co., P. O. Box 1571, Beaumont, Tex., has made available a portable, compact head adaptabel to any make of cutting torch for oxy-acetylene cutting operations. The self-contained power unit does not require any electrical connections. Speed is variable for both light and heavy plate. Straight lines, bevels, and curves can be cut in all positions. No

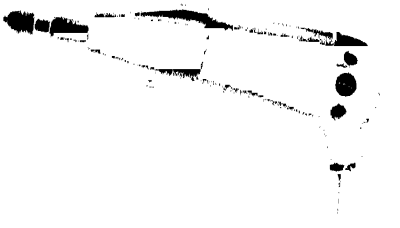


jigs or fixtures are required to start or finish the cut on the plate edge.

The torch holding adapters on this unit are adjustable for varying degrees of bevel. The spring operated motor is wound with a key shown at the top of the unit. The button shown beside the winding key provides speed control A heat resistant alloy is used for the wheel which supports the unit and the torch. The unit is 7¼ in. long, 3 in. wide, and 7 in high It weighs 7 lb. Vertical adjustment is 4 in.

"Multi-Purpose" Tool Reciprocates 3/8 in.

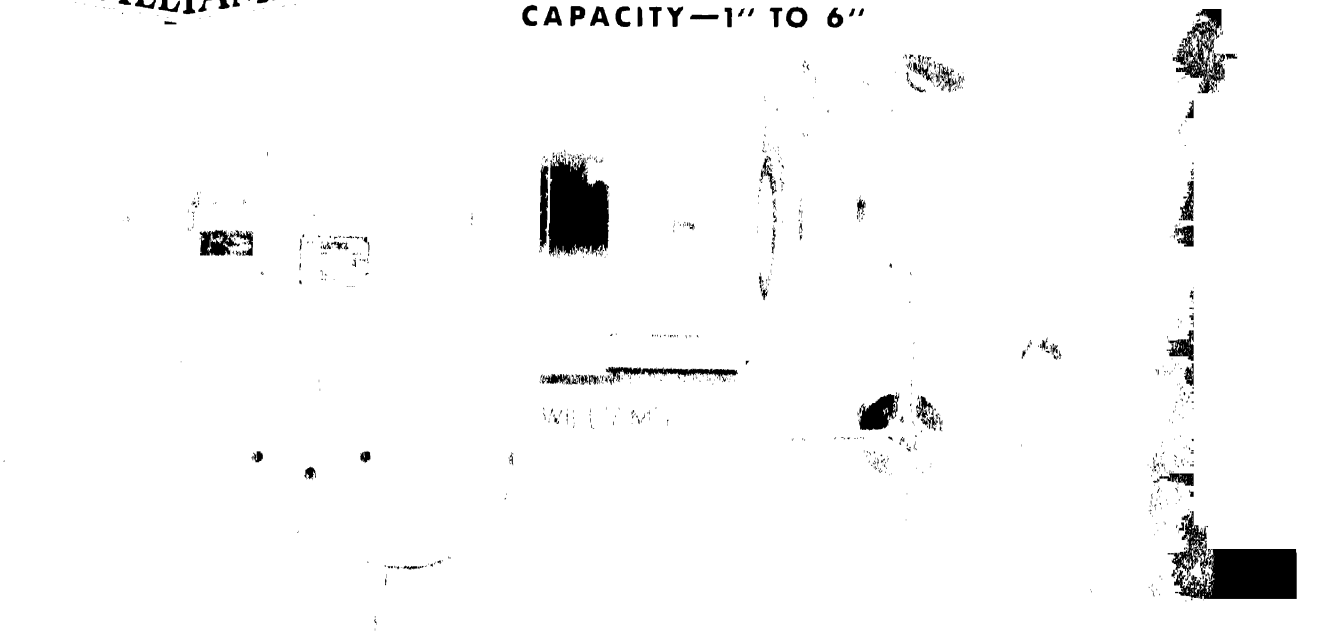
A reciprocating-action tool with more than three times the power of any model previously developed has been announced by H & H Research Co., 1925 W. Buena Vista, Detroit, Mich. With a stroke of ⅜ in., this Series "C" "Multi-Purpose" machine de-



OSTER THREADING EQUIPMENT WILLIAMS

WILCO PIPE THREADING AND CUTTING-OFF MACHINE

CAPACITY—1" TO 6"

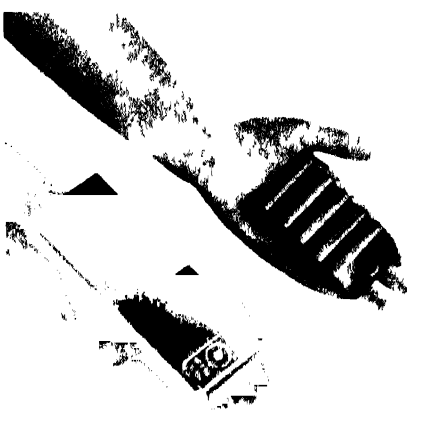


Preferred by Maintenance Men

Modern management rejects the old-style custom of using make-shift equipment and methods on maintenance work. Maintenance departments today are recognized as of basic importance to the efficient operation of manufacturing plants. For maintenance pipe-threading the national preference is the Wilco No. 706—a machine low in first cost but high in output, low in minutes-per-job but high in length of service. Read the two paragraphs at right . . . then send for complete descriptive bulletin.



This single die head takes care of all sizes of pipe within range of machine without change of dies except when change of pitch is required



Small dies held in massive holders mean a decided economy in die costs for Wilco owners

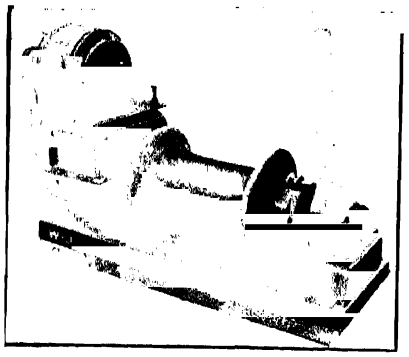
The OSTER MANUFACTURING COMPANY

Sales Offices 2049 East 61st Street Cleveland Ohio
Factories Erie Penna and Cleveland Ohio
New York City Office 30 Church St
Threading Headquarters Since 1893

velops a 30- to 40-lb. push or pull at the end of the chuck. It may be used to file, burr, hone, snag, polish, saw and chip. Under full load it travels at 1,250 to 1,400 strokes per minute and will handle a ¾ in. square hone on heavy work and a ⅞ in. one on lighter work. The machine is powered with 1/30 hp. universal 110-volt motor. Gear ratio is 4:1. Gears and bearings are of hardened bronze.

Stephens-Adamson Winch Incorporates Speed Reducer

The "Saco" speed reducer winch announced by Stephens-Adamson Mfg. Co., Aurora, Ill., is furnished in a variety of sizes to handle large or small capacities. One of the features of these winches is a jaw clutch which releases the pulling rope when disengaged. This feature is of particular importance where it is necessary to carry



the pulling rope a considerable distance to attach to the object to be moved. Ordinarily, it is necessary for the operator to run a winch in reverse direction to pay out rope; with the jaw clutch releasing pulling rope this is unnecessary. The first reduction of these winches is through adjustable V-belts while the second reduction is through cut steel helical gears inside the cast iron housing.

Progressive Portable Welder Has Two Welding Guns

A two-gun portable spot welding unit has been made available by Progressive Welder Co., 3001 E. Outer Drive, Detroit, Mich. It is designed for heavy duty welding requiring high point pressures, large capacity transformer and adjustable weld time control. Equipped with pneumatic tires for easy portability, the unit is wheeled from one assembly location to the next as needed, rather than moving the work to the welding equipment. The unit can be used to serve a group of welding fixtures used for sub-assemblies, as well as occasional assembly line operation. Setting up for welding in a new location is a matter of minutes, since the only connections to be made are the air lines, water lines and the power lines.

The unit illustrated consists of two spot welding guns, transformer, air-hydraulic pressure booster, weld timer and contactor. Both the push gun (supplied with grounding clamp) and the scissors type gun operate from the single transformer mounted in the base of the carriage. Welding

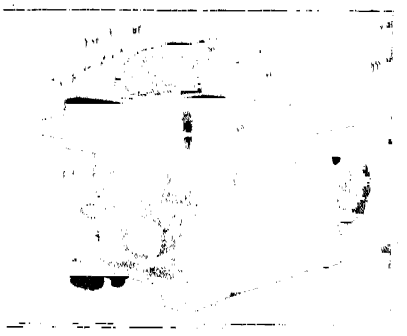


point pressures up to 1,000 lb. for the scissors type gun are supplied by the booster mounted above the transformer and operating from the standard factory air pressure line. Provision is made to water cool the gun jaws and the points through individual supply and return lines. The transformer also is water cooled. Guns other than those shown can be supplied, depending on the type of work to be handled.

When the unit is to be used for more than one type of welding, a special weld timer having two separate control dials permits adjustment for two separate weld times for each gun. In this case, each gun is supplied with two control buttons, the operator using the proper button for the work to be welded. With this type of timer, two operators can use both guns simultaneously on different types of work.

Crescent Abrasive Cutter Is Easily Portable

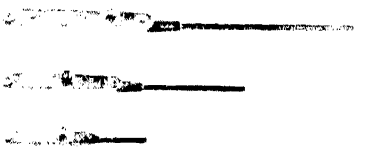
The Crescent Machine Co., 9 Cherry Fork Ave., Leetonia, Ohio, is offering a portable, motor-driven abrasive cutting machine having capacities for sheet metal up to 3/32-in. thick. The machine also is suitable for cutting tile and wood. Aluminum castings are used to keep the weight of this machine down to 71 lb., including detachable legs. The machine proper is 18 in. long, 13 in. wide and 8 in. high. The 8 1/16-in. diameter abrasive wheel projects 1¾ in. above the table for cutting tubing up to 1½ in. outside diameter. An 8-in. steel saw can be substituted for cutting boards. This self-contained unit is driven by a 1/3 hp. Westinghouse motor through a V-belt. Speeds of 3,500 r.p.m. are ob-



tained. The arbor is mounted on S.K.F. ball bearings, while the table is arranged to slide on steel rods.

New Torque Indicators Offered by Blackhawk

Blackhawk Mfg. Co., 5025 W. Rogers St., Milwaukee, Wis., has added a full range of torque indicators to its line. Models having maximum capacities if 133, 175, 420 and 1000 foot-pounds are available in two styles. For small assemblies, the 133 foot-pound "Torkflash", featuring a flashlight signal and pre-set tension, is available. The larger model features a sturdy "Stay-Set" dial. This



dial magnifies deflection of an inclosed spring-steel shaft 26 times, and remains at the maximum torque reading after tension is released. It is then reset to zero by turning the center knob.

Aerovox Capacitors For Fluorescent Lamp Use

Designed to be included in fixtures as initial built-in equipment, or to be added subsequently, a line of capacitors designed especially for fluorescent lamp power-factor correction have been announced by Aerovox Corp., New Bedford, Mass. These capacitors are of the oil-filled paper type and the flat metal can is hermetically sealed. Three types are available, taking care of power-factor requirements for the twelve standard types of fluorescent lamps in general use in industry.

"UCC" Photoelectric Units Made for Industrial Use

The No. 60 series of photoelectric controls, offered by United Cinephone Corp., 43-37 33rd St., Long Island City, N. Y., are housed in compact

inclosures having ½-in knockouts in the bottom for power connections and a fourth knockout on the top for wiring an external photo-cell Telephone-type relays ordinarily are provided, permitting a maximum noninductive load of 3 amp a c, at operating speeds up to ten per second A microswitch to carry 8 amp, or another contacting device handling 15 amp at 110 volts will fit the same housing In the Model 60 unit the photo-cell is separately housed making possible the convenience of mounting the control as much as 5 ft from the electric eye Model 64 unit employs a 3-in collector lens for applications demanding response from as little as 0 5 ft candle with zero residual illumination

NEW MATERIALS

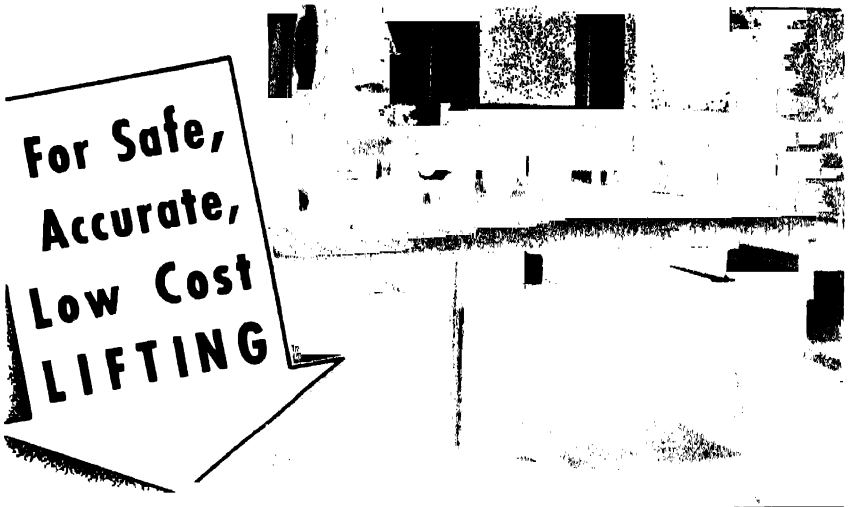
Durez Molding Compound Is Arc Resistant

Durez 8685 phenolic molding compound offered by Durez Plastics & Chemicals, Inc, North Tonawanda N Y was formulated specifically to prevent tracking where there is combined electrical spark and rubbing action It has high resistance to carbonization under an arc While slightly slower to cure in the mold its electrical properties are materially increased by baking after molding It is claimed to hold its high dielectric strength when used at moderately high temperatures It is somewhat more flexible in its final set than standard materials and does not crack under the expansion and contraction of metal inserts around which it may be molded easily

Acheson Colloids Offers Adherent Lubricating Coating

A stable and highly adherent lubricating coating for use in prelubricating surfaces not readily capable of lubrication by ordinary means has been developed by Acheson Colloids Corp Port Huron Mich The coating is applied in liquid form either by dipping brushing or spraying and hardens on exposure to light It provides a relatively high resistance to abrasion and excellent lubrication and corrosion prevention characteristics are claimed

Basic element of this coating providing the lubrication is colloidal graphite, while th presence of small amounts of hardenable organic colloids and a hardening agent, in a water suspension render the composition photo-hardening in character The coatings may be applied at normal temperatures or to surfaces heated up to 100 C to promote drying Lubricating characteristics are not affected by operation of the surfaces at elevated temperatures.



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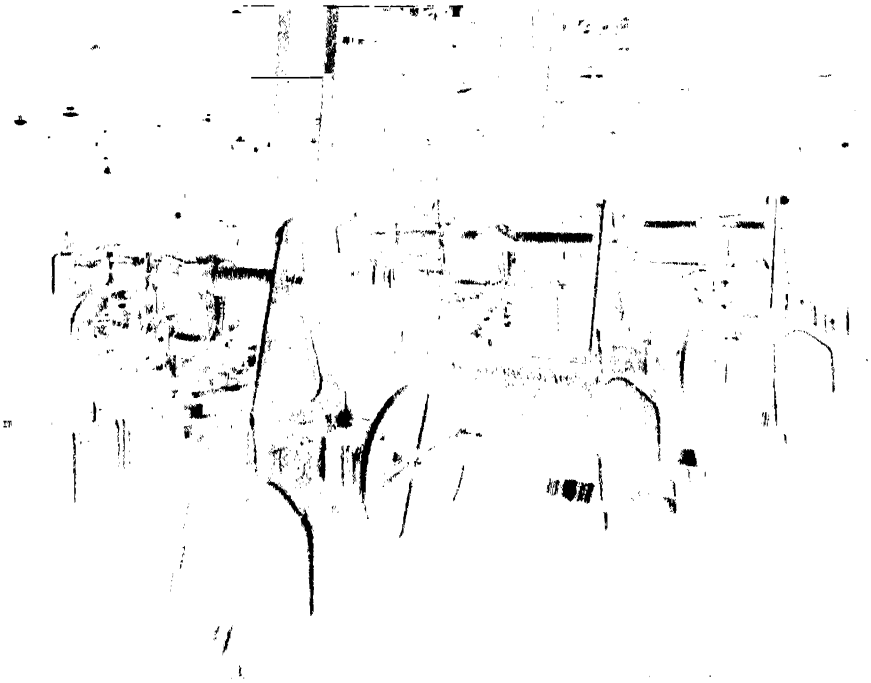
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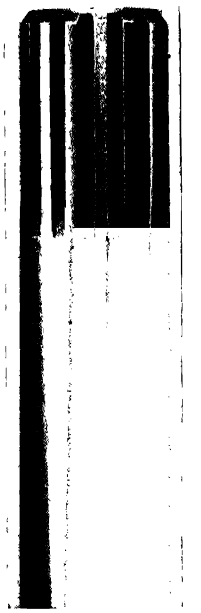
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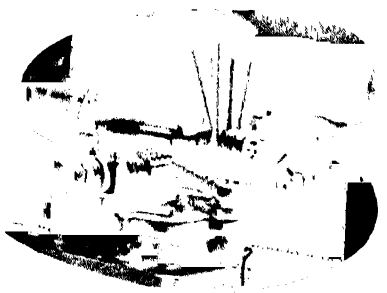
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AMERICAN MACHINIST

July 24, 1940



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June 19, 1940

Mr. W. E. Kennedy, Manager
American Machinist
330 West 42d St.
New York, N. Y.

Dear Sir:

We have received the Modernization Number of American Machinist and I am sure it will be of valuable assistance to us in preparing our machine-tool program for the coming year. We keep it on file, and it is referred to by our Tool Supervisor for checking on new machines for old jobs.

I would like to say, at this time, that the American Machinist is one of the many publications which we receive that I make it a point to read personally. I find both the articles and the advertisements of help in keeping our plant running efficiently.

Very truly yours,

Superintendent

CAF/ls

"I find both the articles and the advertisements of help..."
AMERICAN MACHINIST

WHAT'S IN THIS ISSUE

HOT TIME

Ever since we almost flunked our first course in metallurgy, heat-treating theory and practice have usually enveloped us in somewhat of a fog. Through the years, the mists have gradually cleared, but we are still doubly appreciative whenever someone comes at us with both barrels with language we really understand

Such are our feelings for J L Burns and Victor Brown, of Republic Steel, for their excellent article beginning on page 523 It discusses the whys and wherefores of time quenching in language that makes the points



J. L. BURNS

clear to all The simple time quench, the double quench and the interrupted quench are all taken up and discussed as to the procedure and its effect on the material The authors don't maintain that the most complicated way is always the best, instead, they point out when which should be used where Whether you've been having heat treating troubles or not, we feel certain you'll find "The How and Why of Time Quenching" interesting reading

SOARING STAINLESS

More sound and fury is being emitted by the lay press on the subject of aircraft production problems than on nearly any other You've read about plastic planes which are ready to fly when the glue is dry, about 1,000-hp engines stamped from sheet steel at virtually one crash of the press (actually!), about entire airplanes fused together in one glorious, blinding flash You know the improbability of manufacturing developments proceeding at such a miraculous pace But you may wonder what actually has been done, to make the newspapers get so excited So on page 527 we hereby bring the record up to date on the welding of stainless steel in aircraft structures

LARGE SCALE

When most people see a picture of a man staring into a microscope, they conclude he's some scientific genius busy unlocking more secrets of the universe A few years ago that was probably true, chances are today, though, that he's just measuring something For as metal working methods have advanced, the technique of measurement has been taxed to the utmost Contour projectors are familiar to all, microscopes for inspection and even for setting production tools are finding ever increasing use throughout industry Like most new techniques, misunderstanding has preceded adoption in some cases So the article on page 530 by Joseph Dauber, of Gaertner Scientific Corporation, should evoke considerably more than passing interest

SPEAKING FROM EXPERIENCE

"I served a formal four year apprenticeship in wood patternmaking

I like to get a rise out of machinists and toolmakers by reminding them that a lot of good men have come out of the patternmaker's trade" writes Walter F Simon, who is now supervisor of apprenticeship for the Industrial Commission of Wisconsin Mr Simon speaks with benign tolerance because he has just got a load off his mind That load is his opinion of manufacturers who 'can't'—or won't train apprentices It offers such conclusive proof of the value (to the manufacturer) of apprentice training that we've printed it on page 537. There, under the heading of "No Apprentices?", you'll find some mighty good reasons why you, too, should take a couple of kids under your wing and show them what the score is But to get back to Mr Simon, who, by remote control, strikes us as being an interesting individual "It is a curious fact that according to all available records I happen to be the first person to complete an apprenticeship under this state's original apprenticeship law . . Exactly four years after graduation I found myself in charge of administering it. . ."



JOSEPH DAUBER



WALTER F. SIMON

COMING

When automobile men express approval of aircraft assembly methods, that's news And that's the news we bring you in the story of Republic Aviation and how it gets the utmost out of jigs for mass production It's in two parts, the first of which is scheduled to appear Aug 7

Also beginning in a forthcoming number will be a series of five articles on measurement for production These articles start with the basic fundamentals and work up through the very latest principles and techniques of production measurement. It's by C C Street, of Federal Products Corporation, and will begin in an early issue of *American Machinist*

MODERN with HYPROS

OBSOLESCENCE is the simple process in a machine tool of becoming less and less productive . . . it can easily cost you the price of a new Hypro.

MODERNIZED Cincinnati Hypro Planers, Millers and Vertical Boring Mills are designed for modern production work of the most severe and exacting kind.—Speed, ease of operation, adaptability, and rigidity are some of the outstanding characteristics of these modern tools which assure large dividends to the cost-conscious production man.

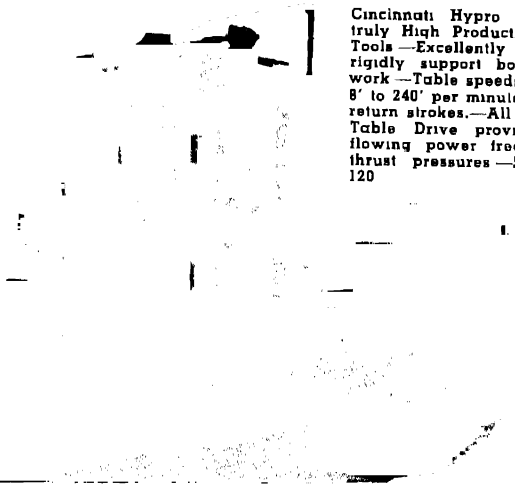


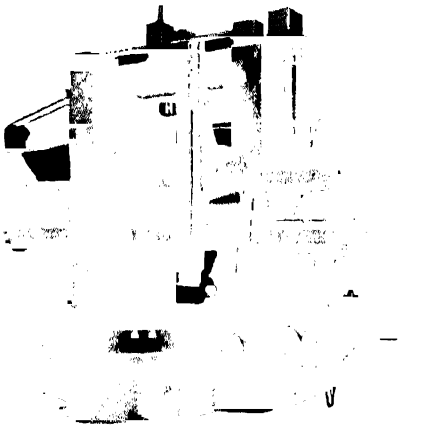
HYPRO MILLLERS

Massive pyramid shape Housings,—Table Drive delivers smooth flowing power free from side thrust pressures —completely self contained Timkenized Milling Heads—these are but three of the numerous outstanding features offered in the new Cincinnati Hypro Planer Type Milling Machine.—Sizes up to 120".

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Cincinnati Hypro Planers are truly High Production Machine Tools —Excellently designed to rigidly support both tool and work —Table speeds range from 8' to 240' per minute on cut and return strokes.—All Herringbone Table Drive provides smooth flowing power free from side thrust pressures —Sizes up to 120



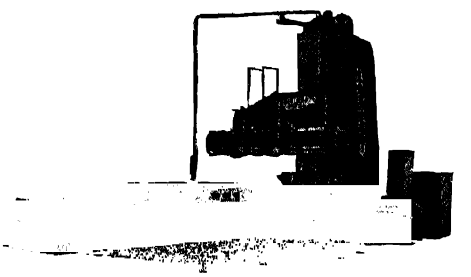


BORING MILLS

Spiral bevel table gear —completely Timkenized speed box—anti friction, roller bearing mounted rail head saddles,—these head a long list of substantial, High Production Features built into Hypro Mills —Sizes 4', 5', 6', 7', 8' 10 & 12', also 10 16' Extension Mill.

OPENSIDE PLANERS

Cincinnati Hypro Planers in both Openside and Double Housing Machines offer trouble free magnetic feeds to all heads. These feeds range in increments of 64ths, from ' to 1' Hypro Openside sizes up to 96".



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Cincinnati Hypro Machine Tools are wiping out bottlenecks and reducing machining costs in other plants like your own.—Each Hypro has many new features which will help to solve some of your most perplexing problems.—For more efficient and low-cost production in 1940, let the sincere, painstaking interest and experience of Cincinnati Engineers help you.

The Cincinnati Planer Co

Cincinnati, Ohio

ESTABLISHED 1877 **AMERICAN MACHINIST** BURNHAM FINNEY, Editor

The how and why of time quenching

BY J. L. BURNS, AND VICTOR BROWN, REPUBLIC STEEL CORPORATION

When water quenching is too severe, and oil does not give sufficient hardness, a double or "interrupted" quench may produce the desired results

TIME QUENCHING probably started with the discovery that immersion in water caused cracks in certain critical parts which could be avoided by removing the pieces from the water after a short interval of immersion. Oil is used, of course, as a less drastic alternative to water, but there exists a gap between the two media which it has been found convenient to bridge by the use of so-called "time quenching."

The usual manner of treating steel parts is to heat them to a temperature somewhat above the critical point, where a crystallographic change from the alpha, or ferrite, phase to the austenite phase takes place, in which the carbides of the common steels are soluble.

When such a state has been produced, the parts are plunged into a media to prevent by rapid cooling the separation of the carbide into its stable soft pearlite. This quenching sets up stresses within the part which may literally tear the steel apart if of sufficient magnitude. This latter usually occurs where stress concentration develops—such as at sharp corners, edges, holes or tool marks. High hardness, high alloy content and drastic quenching all lend themselves to the production of these higher stresses.

It was found that by inducing a drastic quench during the early stages of the cooling, and then decreasing its severity toward its finish, that it was possible to reduce the stresses and any subsequent tendency to crack.

The word "time" denotes that exposure to a given quenching media is a measured one. The simplest time quench would be to expose an article to one liquid quenching medium for a predetermined period after which it would be returned to the atmosphere. Other forms of time quenching would be "double quenching," in which an article is exposed successively to two different liquid quenching media, at least one of which would be measured in the course of cooling to room temperature, and "interrupted quenching," in which the part is withdrawn from a single liquid medium and then replaced in the course of cooling to room temperature, the time of quenching before and during the interruption usually being measured. Other means of time quenching are possible; but the ones mentioned are the more important.

Specimens 1½ in. in diameter were simple time quenched, using various lengths of time in the quenching medium, which was water at 70 F. Hardness distribution curves were plotted in a common type U curve, showing the hardness distribution across the section of a bar (usually sectioned away from an end to measure accurately hardness differences from the surface through the center), and compared to full water and oil quenches. Fig. 1 is a 0.40 carbon steel, and Fig. 2 a 0.60 carbon steel. These steels offer difficulty when parts of a critical design require thorough quenching for the best physical properties. Even though the time allowed for quenching these parts was limited, the hardening response and the depth of hardening held up well. In Fig. 3, the cross-sections were etched to illustrate the extent of quenching. Concentric rings indicate the depth to which quenching took place. The difference in color of the rings between the various samples is caused by the difference in temperature at which the samples were withdrawn from the water. The

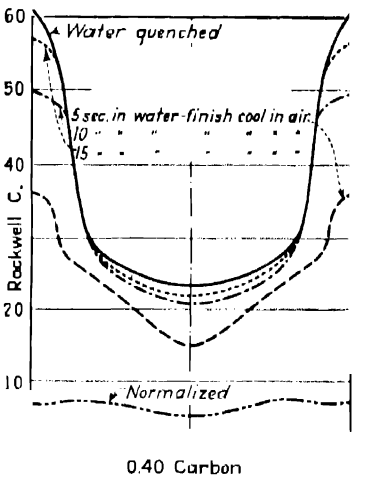


Fig. 1—A series of U curves taken across the section of a 0.40 C steel bar, 1½ in. in diameter, show the variation in hardness for different time intervals

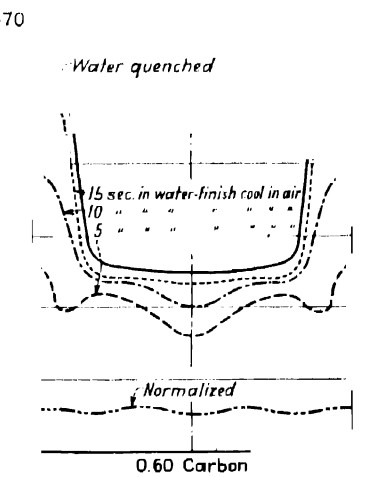


Fig. 2—A simple time quench on a 0.60 C steel bar gives the hardness distribution as compared to a full water quench

TABLE I

Sample No.	Quenching Conditions
1	Straight oil quench
	2 sec. in water – transfer to oil
5	" " " " " "
8	" " " " " "
11	" " " " " "
14	" " " " " "
	Straight water quench

TABLE II

Sample No.	Quenching Conditions
1	Water Quench
2	5 sec. initial quench, 1 sec. in air, back into water
3	5 sec. initial quench, 3 sec. in air, back into water
4	5 sec. intital quench, 5 sec. in air, back into water
5	Oil quench

TABLE III

Cross section	Time
¾–1½"	1 to 15 sec.
1½–2¼"	5 to 25 sec.
2¼–3"	10 to 45 sec.

photomicrographs of a typical simple time quenched sample show the quality of structure through the section.

This method of time quenching is probably the most common deviation from the full quench. Many tool treaters find that it may be successfully used on water-quenching tool steels where parts of critical design would otherwise spall or crack if allowed to remain too long in the bath. Rivet sets, small dies, cutters and pins are handled by timing the quench, which may vary from a few seconds to nearly a minute.

Industrial parts made of water-quenching steels, SAE 1035, 1040, 1050 and 5130, are likewise subjected to such treatment. A machined part made of SAE 5130, for instance, was given a 12-sec. water quench. Maximum physical properties were obtained with (1) a minimum amount of distortion and (2) the least possible danger of cracking.

Some manufacturers modify time quenching by using a water spray either at local points or over the whole part for a given time. Such an arrangement may be automatic and provide a high degree of reproducibility. Tons of steel have been handled by conveyor to give continuous flow of production; this is largely responsible for giving simple time quenching a place in present-day mass production.

Use of a water spray to direct quenching medium to localities where hardening is desired has made this method in many instances a time quench. Reasons: (1) the time factor for handling, (2) the desire to allow hot portions to draw quenched areas and thus release stress, and (3) lower heat-treating costs.

Large conveyor or track links usually need be hard only at points which rub against guides or furnish tracks for rollers. The rest of the part has adequate strength as normalized; therefore, no attempt is made to give any but wear surfaces a drastic quench.

Such a part is heated in a furnace to the usual temperature for the regular length of time. Instead of submerging the entire piece as usual, it is placed in a jig and a jet of water directed at portions desired hardened. A timer on the water valve automatically controls the length of quenching; the wearing surface receives a full quench, whereas the remainder gets only a short time quench extracting sufficient heat to prevent excessive softening. After the water flow is stopped, the piece is removed and later drawn.

This method is typical for handling parts where differential hardness is required. It may be desirable to do some sizing or machining after heat-treating; in such cases these portions may be left soft. Hardness may be varied to a large degree by varying the timing of the jet, or even by varying the degree of draw after quenching.

There has been increased activity in recent years with methods to harden steel pieces locally. Flame and electrical induction hardening have been widely used, and will answer many purposes where time quenching with a water jet or spray would formerly have furnished the best answer. Where an article would have been heated in its entirety and quenched locally by using flame or induction methods, the part may be treated only locally and quenched either wholly or partially. Local heating has certain advantages. Its speed, simplicity of handling, and minimum of scaling and distortion are difficult to duplicate in other methods. In considering methods to be adopted, cost, available equipment, number of parts, and the grade of steel to be treated are all factors which will influence the choice.

Samples 1½ in. in diameter were heated at 1,500 F. for 45 min., then immersed, one at a time, for a given period in water, followed by quick transfer to an adjoining oil tank. The transfer took approximately 1 sec. These tests were made under close control for accuracy; timing used is shown in Table I.

Curves are shown in Figs. 4 and 5, and photographs of etched cross-sections and microstructures in Fig. 6. A peculiar dip may be noticed in some of the curves. This is caused by drawing the outside ring by heat flowing out from the center. The outside surface is thus stress-relieved by tempering and aids in preventing cracks.

While it is difficult to conceive

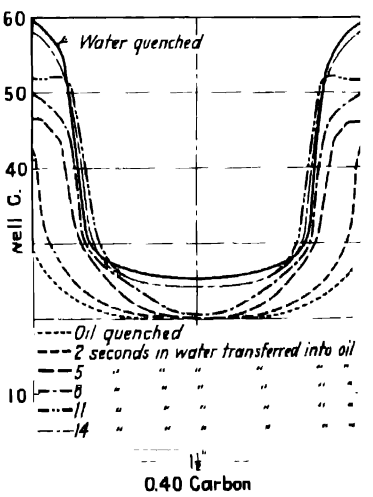


Fig. 4—Hardness distribution is shown for a 0.40 C steel full water quenched, and water quenched, then transferred to oil

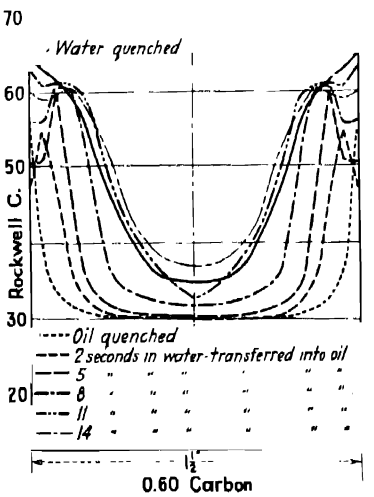


Fig 5—Effect of double quenching is also shown by the hardness distribution curves for a 0.60 C steel for different quenches

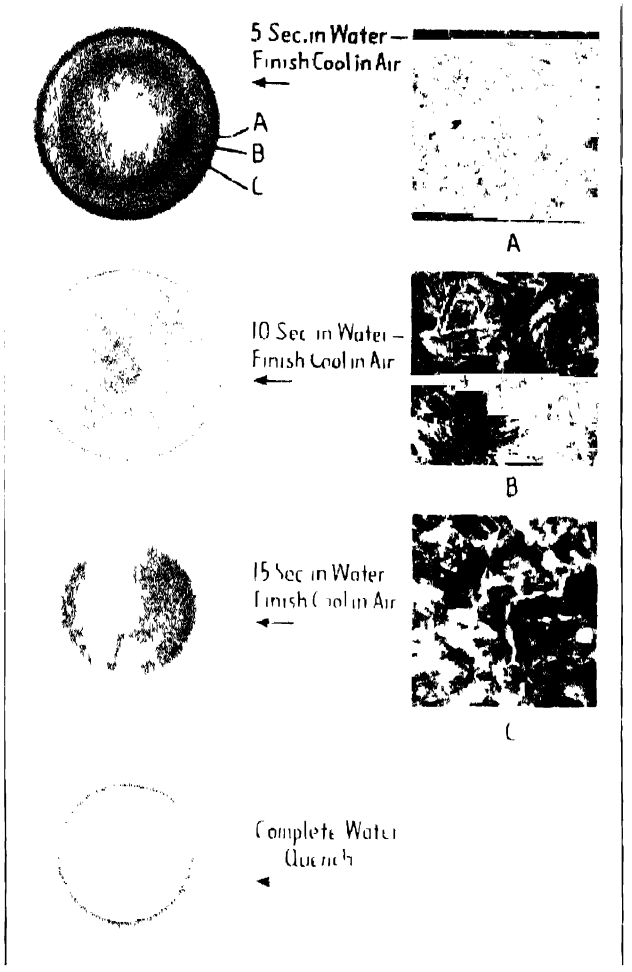


Fig 5 Macrographs of etched cross sections of a 0 60 C steel bar show the varying depths of hardening effect for different quenching conditions

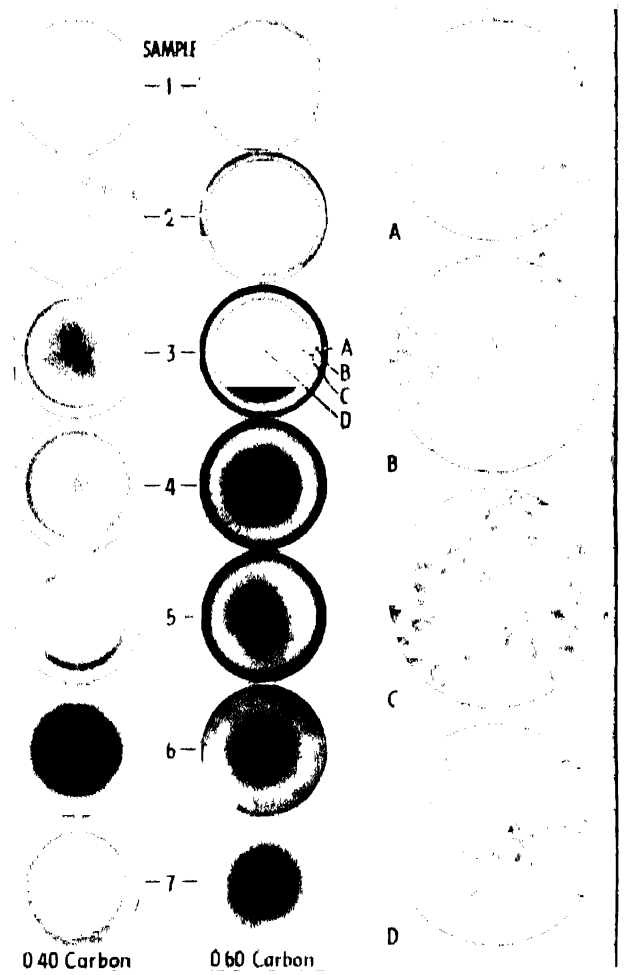


Fig 6 Macrographed cross sections of 0 40 and 0 60 C steel show hardness penetration microphotographs give the grain structure of a typical piece

where a part with a softer surface than sub surface area would be wanted If the need arose here would be a unique way of obtaining it Fig 7 shows curves after varying tempering temperatures, and shows how this hardness gradient may be leveled Photographs, Fig 8, represent a sample of 0 60 carbon steel after it has been tempered Note the uniformly fine structures obtained through the different rings

The main advantage in this method over the simple time quench is on fairly massive parts where the retained center heat might exert too great a tempering action if the part were allowed to finish cooling in air The transfer to a milder oil quench after obtaining the benefit of deep hardness penetration in water, permits sufficient additional heat to transfer from the steel to prevent tempering without exposing the part to the high stresses which would occur if the part remained in water until fully quenched The short interval in air during the transfer produces some drawing as may be seen in the curves and photographs, this also helps to curb severe quenching stresses Certain dies and rather large mill shear knives, handled in this manner, show less tendency to crack and perform well in service Large bull gears made of SAE 1045 steel have been quenched by this method (50 sec water dip) to hold down cracking and also distortion

When a steel is heated, immersed in water withdrawn for a relatively short time in the course of cooling and then plunged back into water it is called interrupted quenching

A group of samples was treated in this fashion to study the effects Time may be varied during any stage of the procedure In this instance the period in air was varied From previous experience with double quenching it was known that 5 sec in water produces a sharp, dark, outer ring, this period became constant The final dip lasted until the sample became completely cold The timing used is shown in Table II

Curves of the two grades of steel and the photograph of etched cross sections shown a striking similarity to those obtained with double quenching

This method is not generally used, but it may have certain advantages as an alternative to double quenching, since it does not involve the use of oil Contamination of oil with water would be objectionable—because it would unfit the bath for strictly oil hardening steel of high hardenability Cracking would be likely to occur Then again, some shops may not have oil and water facilities located near enough together to permit double quenching satisfactorily here particularly interrupted quenching might be used to advantage

Generally speaking, the most economical method of heat treating is the simplest method and time quenching with its many factors cannot be called simple unless used with well arranged and automatic equipment Steels are made today which answer practically all needs using conventional heat treating methods On the other hand, there are some cases where special methods appear to be in order When they occur, we often find ourselves lacking sufficient experience or having

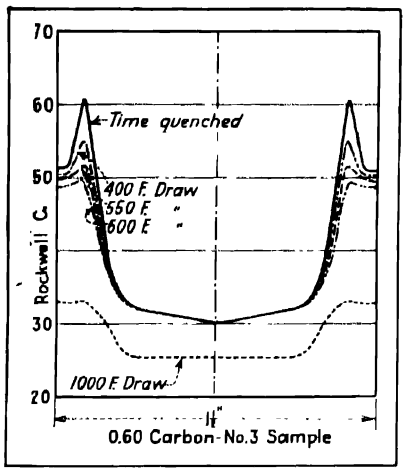


Fig. 7—Heat flowing from the center of the bar may make the outside surface softer than the sub-surface area. Tempering will level this hardness gradient

certain prejudices because of a lack of knowledge of the "unusual" methods which are available. Time quenching often falls in this category, but with proper application has been found to serve a useful purpose.

Proper timing may offer the greatest problem in the treatment of a part. One manufacturer has solved the matter satisfactorily with track shoes by water quenching until the cooling vibrations cease. These parts are immersed with a pair of tongs until the operator no longer feels the vibrations, then withdrawn from the quenching bath and placed on a conveyor running through the draw furnace. Previously, these parts were a constant source of trouble, as they exhibited a consistent tendency to crack. After changing the method, cracking became a rarity.

In deciding on the timing of a given part, the various properties must be considered as well as the reasons for going to a time quench. If the Brinell hardness of the finished part is such that a high draw temperature is necessary, then the heat-treater has a comparatively wide range of time in which to work. The same holds true if the piece is massive. On the other hand, if the piece is small, or where higher physical properties are required, it is necessary to control the timing closely. This is said with the understanding that the work is to be drawn. Even though some drawing is accomplished by the heat left in the steel, it is recommended that any stressed part be given a draw to insure the benefit such treatment imparts.

It is difficult to establish a hard and fast rule for the timing. However, a rough estimate, as a starting point for a new job, is suggested in Table III.

The shorter time in each bracket should be used for the correspondingly smaller sizes, for high hardenability steels or for lower hardness. For instance, on an approximate cross-section of $\frac{3}{4}$ in. on an 0.40 plain carbon steel, the timing for 55 Rockwell C hardness at the surface would be 3 sec. (double quenched) while a $1\frac{1}{2}$-in. cross-section of the same grade would require 11 sec. to obtain a similar degree of hardness.

If a 0.60 carbon steel were used we would find it impractical to time quench a $\frac{3}{4}$-in. piece, since it would handle well in oil, and the $1\frac{1}{2}$-in. piece would require only 5 sec. to obtain the same surface hardness of 55 Rockwell C.

Judgment in timing is soon gained by a good heat-treater; where a number of parts are to be run, timing may be adjusted if the first pieces show a deviation from the desired hardness.

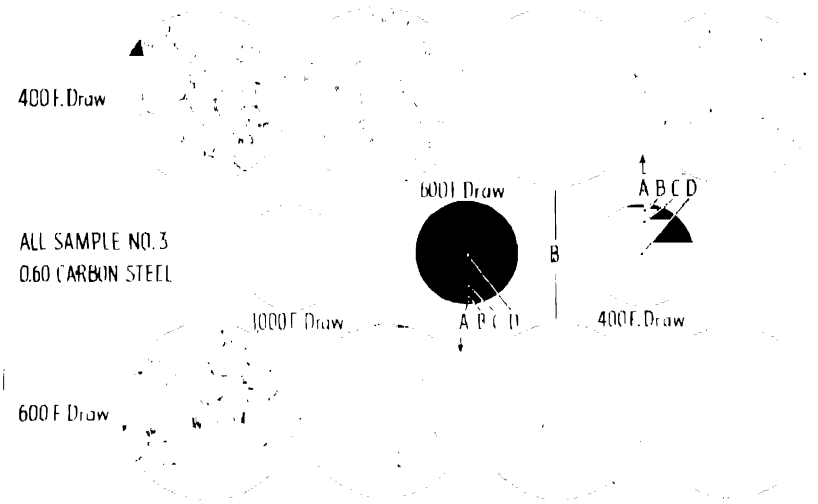


Fig. 8—Tempering may be used to give uniformed fine structure through the different rings as in these 0.60 C steel samples

Shell Peeves

DEAR SIR:

I was unfortunate enough to learn what I know about the machinist's trade by actually working at it.

That seems a ridiculous way to do it today when they learn it in a CCC camp by planting trees and building roads and reading books on shop management in a college course and listening to lectures by someone who got his the same way.

My present "pet peeve" is the very foolish practice, being attempted on all sides, of not machining the inside of shell but "finish forging" them. Everyone falls for it and if they ever try it in *mass* production the "hospital" will be the largest department in a shell shop. Frankford makes 525 5-in. Navy shells per shift that way and tell you they are "as forged" inside, but if you tip them up and look into the end you'll see a scraping cut in the bottom scale was taken when they faced the open end on their four-station horizontal Baker machine.

They may get by with this on shell up to 6-in., but never as satisfactorily as if they are machined.

Another thing that "gets me down" is the tendency to use high speeds and microscopic feeds. The crowning insult to intelligence is when you are shown a slick and slippery finish turned shell that looks as if it had been nickel plated and your attention is called to its beautiful appearance.

That appearance comes from a feed of about 0.006 in. with carbide tools.

The best feed for shell finishing was pretty well determined at around 0.070 in., and there was a reason. The feed should be coarse enough to hold paint or grease well and, *above all else*, to provide a secure hand hold for the man in the field.

These slick surfaces on shell as large as 6 in., that weigh 100 lbs. or so, are positively dangerous for artillerymen to handle at speed.

LUCIEN I. YOEMANS,
Lucien I. Yoemans, Inc.



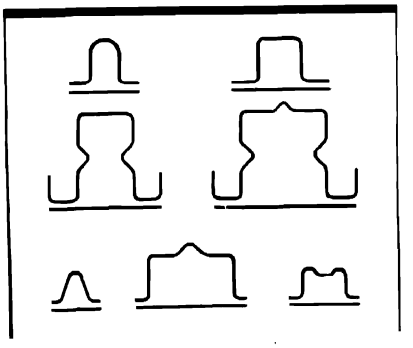
The Fleetwings Sea Bird is constructed almost entirely of stainless steel. High electrical resistance and low heat conductivity of the material make possible rapid and economical fabrication by spotwelding

Stainless steel in aircraft

BY CARL DE GANAHL VICE PRESIDENT FLEETWINGS INCORPORATED



Wings, control surfaces, fuel tanks and complete planes of stainless steel are fabricated rapidly and economically by spotwelding. Thin-gage stock is used for structural parts



Stringers and stiffeners for Fleetwings aircraft structures are made from flat thin gage stainless steel. The flat material is rolled to form channel sections with narrow flanges for welding to flats producing closed box beams, I beams and other shapes. The small diameter of the spotweld makes possible the use of narrow flanges without sacrificing strength

WHEN STAINLESS STEEL was first offered in thin gage strips with tensile strengths approaching 200,000 lb. per sq. in., with excellent elongation and other physical properties, Fleetwings, Inc., developed spotwelded steel structures suitable for aircraft. The thin gages required for lightweight construction necessitated the design and development of special forms and shapes of these structures to sustain compression and torsion.

Special tools had to be devised and made for manipulating the metal. When this had been accomplished, and extensive fabrication of plane structures was undertaken, it was found that production could proceed on an economic basis. Plane wings, control surfaces, fuel tanks and complete amphibian aircraft of stainless steel are now in successful production. Among recent products built by Fleetwings are control surfaces for Republic P-35 pursuit planes and Stinson aircraft, as well as wings and wing tip floats for Douglas Dolphin amphibians. Also, the Fleetwings Sea Bird for the commercial market has a basic structure of stainless steel.

Stainless steel used in the manufac-



Sub-assemblies of stainless steel control surfaces are spotwelded in individual jigs. Leads for the spotwelding tools are clamped to two heavy bus bars running down the center of each work bench. The bus bars are connected to a single spotwelding machine, regardless of the number of spotwelding tools used at the bench



Final assembly of control surfaces is accomplished with the aid of jigs. Portable spotwelders controlled by foot-pedal switches speed the work. The built-up sections rolled from flat stainless are used in making the sub-assemblies of hinge brackets and stiffeners for the control surfaces, which are finally covered with fabric

ture of these aircraft and component parts is obtained in strip form 24 in. wide and thicknesses from 0.006 in. to 0.095 in. and more. In these thicknesses it can be obtained with a minimum tensile strength as high as 184,000 lb. per sq. in., a yield point of 150,000 lb per sq. in., and elongation between 12 and 20 per cent. It is tough, will stand considerable abuse in forming and twisting, and has high fatigue values. It is austenitic with a characteristically high electrical resistance and low heat conductivity; these prove advantageous for rapid and economical fabrication by the spotwelding process and make possible spotwelded joints of high strength

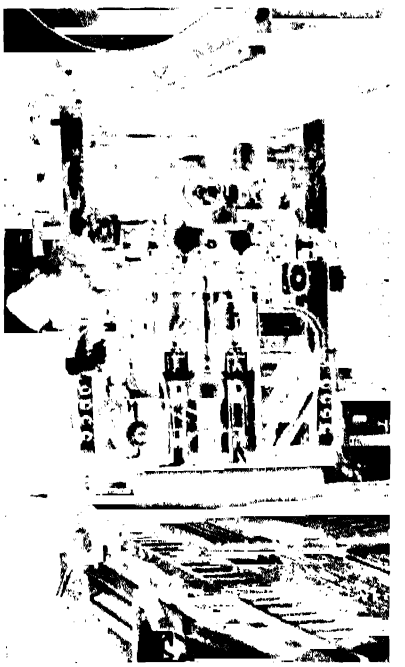
Stringers From Flat Stock

Since the thin gages of stainless used have little lateral stiffness, the sheets are rolled or corrugated to form channel sections with flanges, which are then welded to flats to produce closed box beams, hollow-web I-beams and other shaped stringers and stiffeners. These structural shapes are strong in both compression and torsion. The small diameter of the spotweld permits the use of narrow flanges, allowing minimum weight. A flange $\frac{3}{16}$ in. wide suffices for welding typical stringers, but $\frac{1}{8}$-in. flanges on some members have proved adequate for constructional purposes. Typical stringers and stiffeners are made with forming rolls from flat stock in the shapes illustrated in one of the drawings.

These built-up sections are used in the fabrication of wing ribs and stiffeners, fuselage sections and ribs, nose sections and hinge brackets for movable control surfaces. All sub-assemblies for the latter are built in individual steel shapes. The hinge brackets and nose assemblies are mounted in small steel jigs on a work bench along the center of which run two heavy copper bus bars which are connected by two heavy secondary leads to a portable welder controlled by a foot pedal switch. Portable spotwelding tools are connected to the bus bars; the tools are of various shapes, depending on the nature of the job and the position of the spotweld required. Thus, only one welding machine is required for each workbench, regardless of the number of individual spotwelding tools required at the bench. Sub-assemblies made at these benches are mounted in final assembly jigs and when properly held in place are welded together with a portable spotwelder. Final assembly of these movable control surfaces is shown in the illustrations; the assemblies are later covered with fabric.

The technique followed in making large wing panels is typical of the engineering and fabrication methods used for all structures. The wings are a D-section monospar type in which a single shear web of corrugated stainless steel with a vertical stiffener is provided at about 30 per cent of the chord. The nose ribs are bolted in place to the shear web, and over them is stretched a covering of corrugated sheets which vary in thickness from the root to the wing tip. Sheets 2 x 5 ft. and 0.01 in. thick are corrugated in a press, their ends overlapping so that the corrugations mate; these are then welded together, forming a single sheet for the nose covering. It is stretched over the nose ribs, welded directly to the ribs, and bolted to the shear web. This completes the structure of the wing nose.

Cantilever ribs are bolted to the back of the shear web and covered



The skin is formed by welding flat sheets to corrugated stock in this machine at a maximum rate of 960 spots per minute. Oversize rods are placed in the corrugations to produce the result shown at the lower right of the drawing. When the skin is bent around the leading edge of a wing, it stretches, reducing the high spots and making a perfectly smooth surface. The welded skin at the lower left in the drawing was obtained before oversize rods were used in welding the corrugated sheets to flat stock

with fabric from the shear web aft. This completes the wing structure. Some of the wing panels are 30 ft. long, have a root chord of 16 ft., a maximum thickness at the root of 18 per cent of the chord and 9 per cent at the tip, an under-surface area of 350 sq. ft., and weighs 762 lb. Full advantage of the strength-weight ratio of stainless can best be obtained in such large structures, since thick-gage strip can be used.

A feature of the wing construction is that fuel tanks form part of the lower skin, and are built to carry the necessary stresses. Corrugations in the side metal prevent bulging. Joints are made liquid tight either by seam welding or spotwelding for strength, and filling in the joints with solder.

A large amount of local stiffness in the skin is desirable in the leading edges of wings, in split flaps and in fuel tanks where pressure is heavy. In order to obtain the required stiffness, stainless steel sheets 0.005 in. thick are formed into corrugations $\frac{3}{16}$ in. deep and having a $\frac{5}{8}$-in. pitch. These corrugations are then spotwelded to a flat sheet of the same thickness, making a skin $\frac{1}{4}$ in. thick; this is the skin which is stretched around the nose ribs of the wing as previously described.

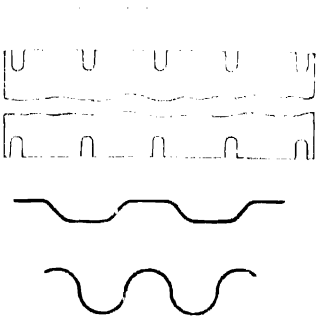
Making the Corrugations

There are two major problems in this type of skin construction: first, the making of corrugations with satisfactory compression strength, and second, preventing the formation of flats in the skin between the corrugations when it is bent around the nose ribs to form the leading edge.

The first problem was solved by forming semi-circles of the corrugations with a depth equal to half the pitch, each corrugation being tangential to the adjacent one. High compression values can be obtained with this design when compared with the sine-curve type of corrugations usually made in light alloy metals. The semi-circular corrugations must be uniform in each sheet in order to have them fit together accurately when overlapped and make strong joints. This is accomplished by notching the ends of the flat sheets at accurately spaced intervals, and registering these notches in locating pins in the corrugating press. Hence, when the sheets are pressed they do not slip and uniform corrugations are assured. One die in the press first forms the parts of the corrugations where the semi-circles are to tangent to each other; then a second die forms the corrugations to the required radius. The form of the sheet at the end of each of these operations is shown in one of the drawings. This method holds the variation in corrugations within 0.005 in. in 24 in. of developed material.

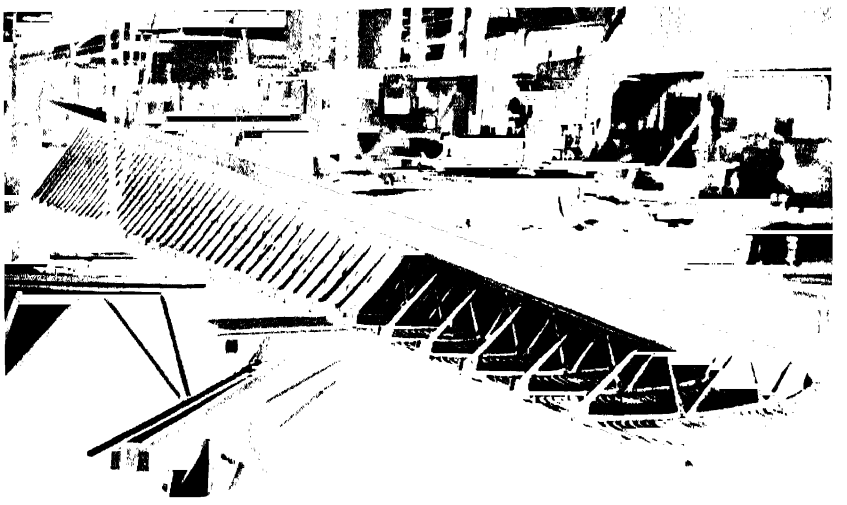
Prevention of Flat Spots

The second problem in skin construction—the prevention of flats between crests of the corrugations when the skin is bent around the nose ribs —is overcome by laying over-sized rods in the corrugations before placing the flat sheets on top and welding them to the crest of the corrugations. This method of preparing the corrugated and flat sheets for welding is illustrated. It results in sufficient excess metal between the crests to produce a wavy appearance when the skin is flat; when it is stretched around the nose ribs of the wing, these waves become smooth and follow the contour of the nose.



Corrugations in Fleetwings skin construction are semi-circular. They are formed by notching flat stainless sheets at accurately spaced intervals and fitting the notches into locating pins in the corrugating press. This prevents the sheets from slipping under pressure and assures uniform corrugations. Because the latter are semi-circular, rather than of the usual sine-curve type, the sheets are pressed in two steps; the lower two views show the two stages of forming the semi-circular corrugations

To expedite the welding of the flat nose surface to the corrugations, Fleetwings uses an automatic spotwelder capable of making as high as 960 spot welds per minute. A copper grid connecting all parts of the machine electrically is mounted on a table which rolls on tracks. The corrugated sheet is placed on the copper grid with the corrugations at right angles to the table movement. Oversized rods, mentioned previously, are placed in the corrugations, and a flat sheet of stainless steel is stretched over it; the ends of the flat sheet are held by jacks which stretches the sheet until all sags and wrinkles are removed. A heavy pair of rollers, one immediately aft of the electrodes and one immediately forward, act as rolling clamps to hold the flat sheet firmly against the corrugations and prevent twisting while the sheet is being welded to the corrugations. A roller welding machine slung on an overhead track parallel with the corrugations is moved by rack and pinion at variable speeds. When the welder electrodes are lowered into contact with the flat sheet, welding starts. The variable-speed drive gives three welding ranges of 240, 480 and 960 spots per minute.



The leading edge of a 30-ft. wing panel is made of spotwelded ribs, stiffeners and corrugated skin, all of which have high compression and torsional strength. The assembly is bolted to a shear web. Cantilever ribs, running aft from the shear web, are bolted in place and covered with fabric to complete the wing

55028

The microscope as a shop tool

BY JOSEPH DAUBER, GAERTNER SCIENTIFIC CORPORATION

Continual narrowing of production tolerances in the metal working industry has brought with it a need for very precise measurements. Microscopes often fill the bill in this respect

THERE ARE TWO MAJOR CLASSES of measuring microscopes. First, there are microscopes, which form a part of a larger apparatus, used for the purpose of making settings to greater accuracy than otherwise would be possible. Although the microscope in this case may seem a mere accessory, it is an essential part of the instrument. It would be impossible to use the full precision of the measuring element without the microscope, and many objects cannot be measured by any method which involves contact.

The second class of measuring microscope involves measurement within the microscope itself. These may be termed micrometer microscopes. They are frequently used in conjunction with other measuring equipment, particularly scales.

The major classes of industrial microscopes can be subdivided as follows: When the microscope is used for setting only, with external measurement, there are two types: (1) moving microscope with stationary stage, and (2) stationary microscope with moving stage. When measurements are made inside the microscope, it may be one of two classes: (1) a scale micrometer microscope with the object measured by a scale, and (2) a filar micrometer microscope with the object measured by a micrometer screw.

The advantages of using measuring microscopes are obvious. The instrument does not touch or affect the object being measured, unless the object is sensitive to the light of the spectral region being used. The object or phenomenon can be viewed and measured simultaneously. No ground glass or screen is required; vision is clear. Only a comparatively low illumination is required, making for small and cool light sources. Measuring microscopes are easily set up. They are largely self-contained and, except for the largest types, are quite portable.

Among the disadvantages of measuring microscopes are the following: (1) the instrument can be used by only one observer at a time, and (2) for measurements of high precision, magnification must be increased. This increase of magnification narrows down the field of view on the object and decreases the working distance between the objective and the object.

A blanket statement as to the limiting precision of measurement cannot be made to cover all cases. The choice of proper optical constants depends on shape, size, transparency, and accessibility of the object being measured. Generally, the limits may be stated as follows: Under ordinary conditions measurements can be made readily to a fraction of a ten thousandth of an inch, and under the most favorable conditions and line settings, to a fraction of a hundred-thousandth of an inch. As compared with unaided visual line setting, the accuracy of setting with a measuring microscope roughly can be taken as proportional to the magnifying power. A measuring microscope with 60 deg. crosslines and a total magnification of 30X to 35X can be depended on to repeat line settings within 0.00005 in.

The following formulae, although only approximately true, will be of assistance in selecting microscopes. Those marked with an asterisk do not apply to compound microscope objectives, usually of 16mm focal length or shorter, for which tables supplied by the manufacturers should be consulted. Most microscope objectives used in measurements are achromatic doublets, and for these the formulae will hold within a few millimeters.

If W is taken as the working distance (distance from object to lens) and T is the optical tube length (distance from lens to reticle), and Fo is the focal length of the objective, then:

$$\frac{1}{W} + \frac{1}{T} = \frac{1}{Fo}\ (*)$$

If Mo is the magnifying power of the objective, then:

$$Mo = \frac{T}{W}(*), \text{ and } T = Fo\,(Mo + 1)$$

For total magnification,

$$Mt = Mo \times Me$$

where Mt is the total magnifying power of the entire microscope and Me is the magnifying power of the eyepiece. A Ramsden type eyepiece is assumed throughout this article, since this eyepiece is most suited for measuring applications.

For a telescope, the last equation given above should be restated as:

$$Mt = \frac{T^2}{Fo \times Fe}$$

where Fe is the focal length of the eyepiece.

For field diameter,

$$Do = \frac{Dd}{Mo}$$

where Do is the diameter of the field on the object and Dd is the diameter of the reticle diaphragm.

A typical scale micrometer microscope is shown in Fig. 1. When using this microscope a suitable graduated scale (reticle), placed in the focal plane of the eyepiece, appears superimposed on the magnified image of the object being measured. The constants of the system preferably are so adjusted that a direct reading is obtained. If S is the actual spacing of the lines on the reticle, Mo the magnifying power of the objective lens with the tube length used and d is the value of each division of the reticle scale in the reading, then

$$d = \frac{S}{Mo}$$

It generally is inadvisable for the user to do any machining on the microscope tube in order to change the magnification by changing the tube length. This is better effected by interchanging objectives, of which there is a sufficient variety available to cover most useful ranges of measurement.

It would seem advantageous to use the highest possible magnification, thus obtaining highly precise readings with comparatively coarse scales. However, it should be borne in mind

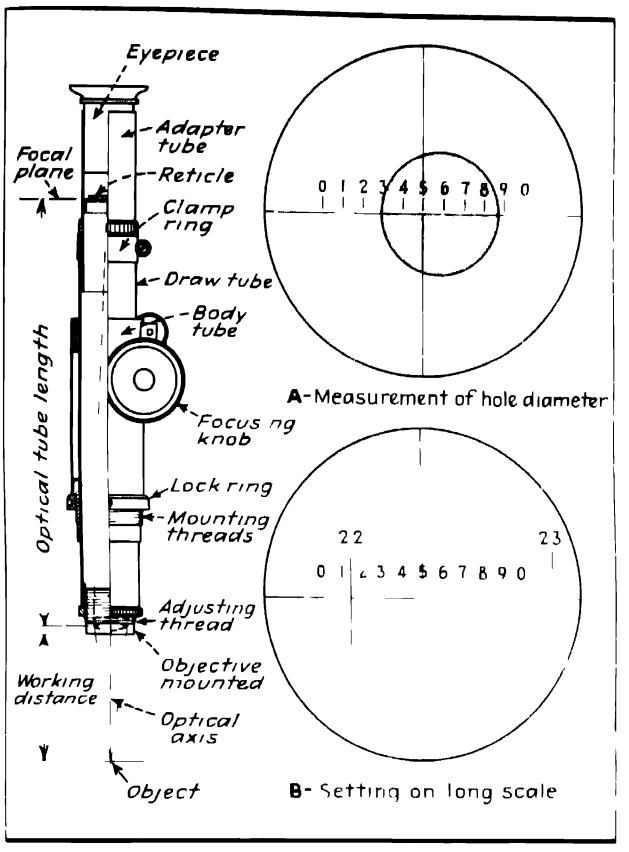
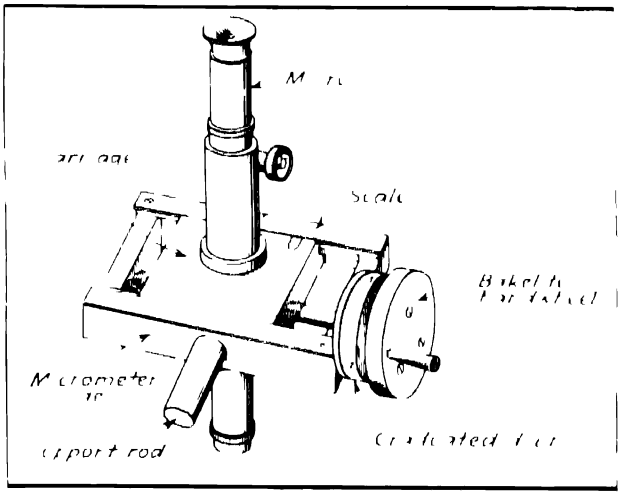


Fig 1—In the scale micrometer microscope a graduated scale reticle in the focal plane of the eyepiece appears superimposed on the magnified image of the object A direct reading may be obtained when the constants of the system are properly adjusted

Fig 2—Moving microscope fixed stage instruments incorporate a means for supporting and moving the microscope while measuring precisely the linear distance it is moved Micrometer slides for such setups have been made with as much as 8 in movement



that increasing the magnification shortens the working distance, reduces the field of view, increases the illumination necessary, increases the cost of the objective and makes the equipment more sensitive to disturbances The lowest possible magnification should be almost always used and it sometimes is even preferable to obtain the last desired figure of a reading by interpolation

At *A* in Fig 1 is shown the field of view of a scale micrometer microscope when measuring the diameter of a hole In this case each division of the scale is equal to 0 001 in on the object, and the range of measurement is 0 1 in Therefore, the diameter of the hole is 0 0576 in At *B* in this same illustration is shown the field of a scale micrometer microscope when used for setting on a longer external scale A long scale suitably engraved can be attached to the moving portion of a machine tool and the scale micrometer microscope mounted in a fixed position on the machine The position of the movable part then can be read by means of the microscope In the setting shown at *B*, the setting on the long external scale is 2 2145 in

When measurements are to be made by moving the microscope a fixed stage instrument is used As shown in Fig 2 such a set up consists of a microscope and a micrometer slide which is the measuring element This is one of the most versatile and least expensive of high precision measuring instruments It can be used both for vertical and horizontal measurements Usual ranges are 1 2 and 4 in semi special micrometer slides can be had in 6 and 8 in ranges Ordinary models read 0 0005 in per division of micrometer drum and are accurate to about 1 division High precision models read to 0 00005 in with a vernier

The carriage of the micrometer slide which is provided with a threaded hole for the microscope body tube is moved on straight parallel ways by a nut which traverses the micrometer screw A bakelite hand wheel provides a good grip for delicate setting and prevents the body heat of the operator from reaching the screw

The entire range of measurement on the object must be illuminated, or the microscope itself must carry an illuminator The comparatively long distance between the object and the ways requires that the latter be accurately straight since any tilt will result in rather a large error Several types of moving microscope fixed stage instruments are available These differ principally in the method of supporting the micrometer slide for convenience in making certain types of measurements

The cathetometer is a special type of moving microscope for covering large ranges usually in a vertical direction and usually without a measuring screw A scale is used as the measuring element When used for distant or otherwise inaccessible objects it is provided with a telescope rather than a microscope A cross hair in the telescope is set on the object by the observer the height of the telescope being read from the scale on the vertical guide column by means of a vernier on the slide Readings to 0 05mm (0 002 in) are common replacement of the vernier by a micrometer microscope gives closer readings The head of a measuring cathetometer is shown in Fig 3

Because of the large separation between the cathetometer and object, very slight irregularities in the ways can cause considerable errors Therefore a sensitive striding level is placed on the telescope to detect tilt and a delicate adjustment is provided to compensate for it The guide column in better instruments is rotatable on its vertical axis, so that for the most exact measurements a scale can be placed at the same distance from the telescope as the object and as near to the latter as possible measurements being made by swinging from one to the other

A good example of the fixed microscope moving stage type instru

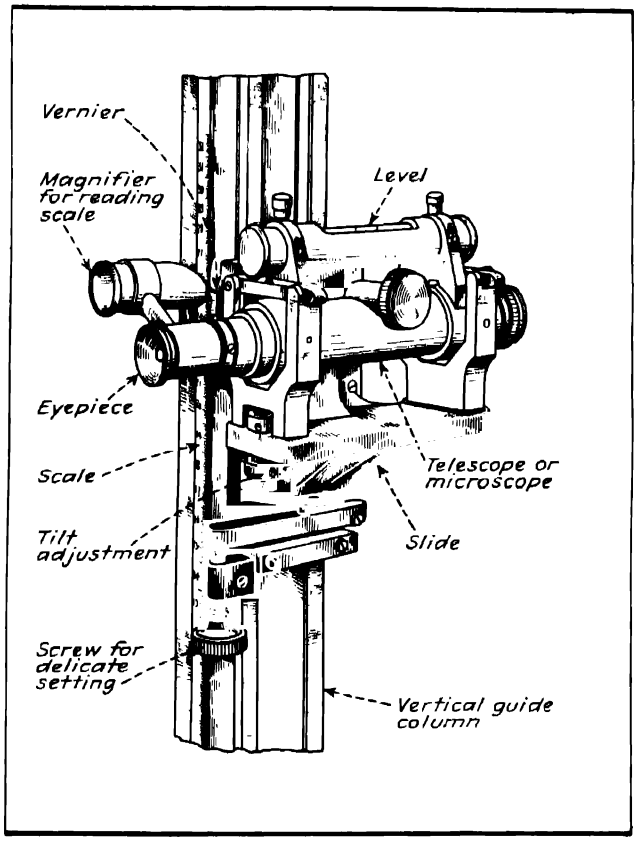


Fig. 3—Cathetometers are used for accurate measurement of vertical distances. Telescopes frequently replace microscopes in these instruments, particularly when used for distant objects

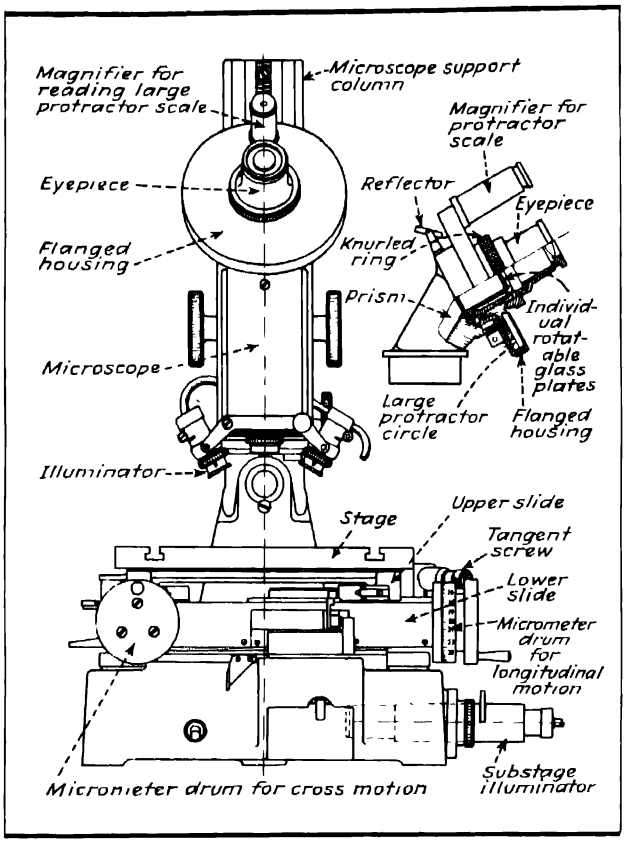


Fig. 4—Coordinates can be measured with accuracy on the toolmaker's microscope. This fixed microscope-moving stage type instrument is one of the most effective applications of optics to shop use

ment is the toolmaker's microscope. This is one of the most elaborate and effective applications of optical methods to technical measurements. Length can be measured in two directions in the horizontal plane and angle in any direction. This enables complete measurements to be made on jigs, tools, screws, hobs, tapers and many other parts difficult, and sometimes impossible, to gage by other methods.

As shown in Fig. 4, when making linear measurements the microscope is set in position and the object moved beneath it on the stage. The stage moves on compact slides which travel on precision ball bearings preloaded in hardened and lapped steel guides. The lower slide moves longitudinally on the base while the upper slide provides the cross motion for coordinate measurements. Each slide is operated by a micrometer screw, the floating nut having a hardened steel insert maintained in contact with its respective slide by spring tension.

The full range of stage travel for a typical toolmaker's microscope is 4 in. of longitudinal motion and 2 in. of cross motion. The micrometer drums are graduated to read 0.0001 in. per division. The stage can be rotated 5 deg. by means of a tangent screw. A micrometer tangent screw showing the stage rotation in tenths of a degree can be supplied with most of these instruments.

To facilitate point-to-point setting on angular objects, such as screw thread profiles, as well as for making angular measurements, the reticle of the toolmaker's microscope consists of two thin glass plates, individually rotatable, the engraved sides of which face each other with very little separation. One plate carries the zero line and a short protractor scale, and is rotated by a knurled ring around the eyepiece. The other plate carries a single line and turns with the large protractor circle which is fully inclosed in the large flanged housing around the eyepiece.

The microscope shown has a total magnification of 30X. The eyepiece is inclined at a convenient angle by a prism which also produces an erect image with natural direction of motion. The microscope support column can be tilted for accurate setting on the contours of screw threads.

Types of reticles for moving microscopes or moving stage measuring instruments are shown in Fig. 5. The most versatile of fixed crossline reticles is that shown at *A*. This 60 deg. reticle may have either spider thread or lines engraved on a glass plate at 60 deg. to each other. Settings are made on wide lines by balancing visually the small triangular portions of the line which appear right and left of the crossline junction. If the line, as it appears in the field of view, is no wider than the crosslines, setting is made by using the line to bisect the clear spaces above and below the junction of the crosslines. On well defined lines, using a minimum of 30X or 35X magnification, it will not be found difficult to repeat settings within 0.00005 in.

For special applications, the parallel crossline reticle shown at *B* is capable of more exact setting than the 60 deg. crosslines reticle, but when the highest precision is required, the spacing of the crosslines should be correlated with the width of the gage line and the magnification.

The 90 deg. crosslines reticle, shown at *C*, is not as useful as the two types just described. In some cases, the horizontal line assists in

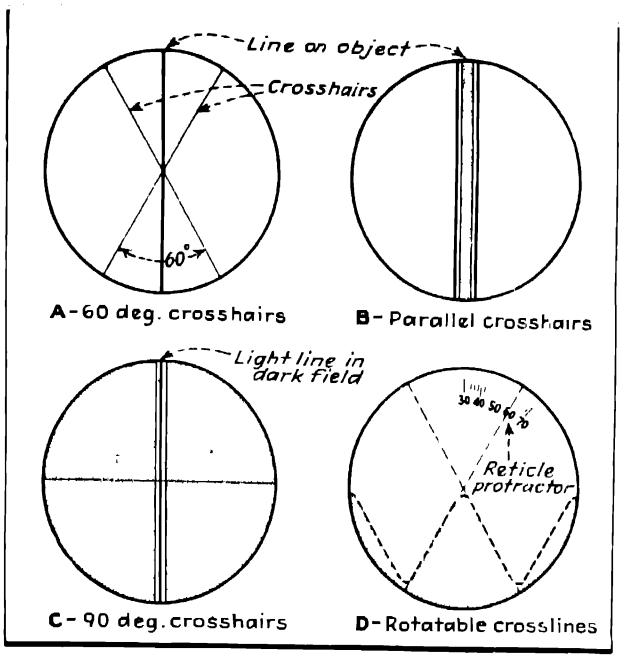


Fig. 5—Different types of eyepiece fields (reticles) are available to suit differing applications of the measuring microscope. Most universally adaptable is the reticle shown at D, which is used in the Toolmaker's microscope

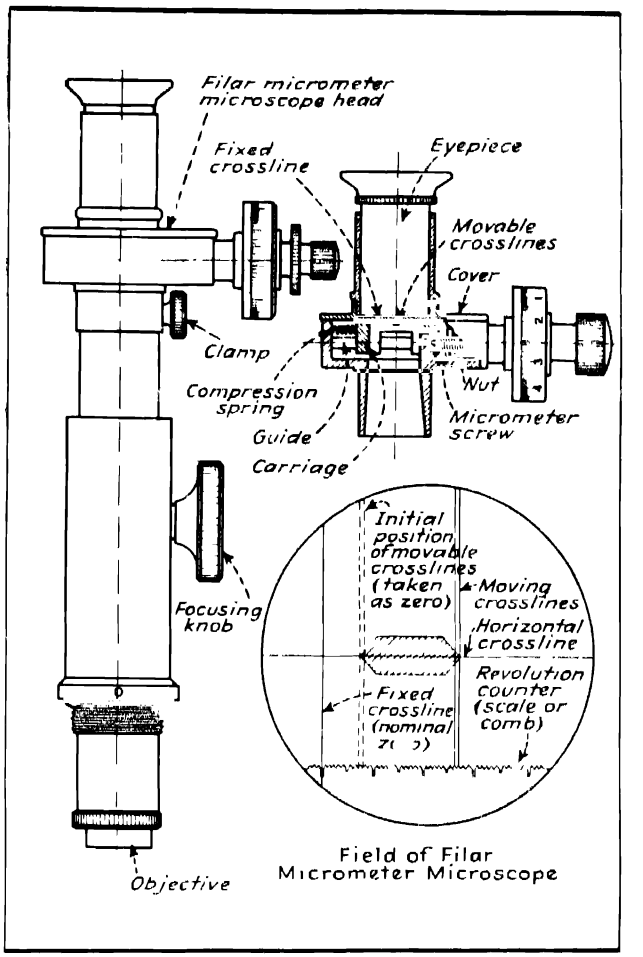


Fig. 6—The filar eyepiece is placed in a standard microscope for measuring the object with a micrometer screw instead of a scale on the reticle

alignment with a similar line on the object. A single crossline is of value in setting on a bright line in a dark field.

The rotatable interrupted crosslines used in the toolmaker's microscope are shown at *D* in Fig. 5. They are rotatable with respect to one another through 360 deg.; the rotation is measurable to ½ deg. by the reticle protractor scale, and to 1 min. of arc by the large protractor circle mounted in the flanged housing as shown in Fig. 4. Settings are made easily on lines or contours, either as shown at *A* in Fig. 5, or by using the edge of the contour to bisect longitudinally the reticle crosslines as at *D*.

The measuring element of the filar micrometer microscope is a filar eyepiece micrometer available separately, as well as in combination with a calibrated microscope. A small carriage bearing a pair of parallel crosslines is moved across the field of the eyepiece on accurate guides by means of a micrometer screw. On the shaft of the screw is mounted, friction tight, a drum with a suitable number of graduations, usually 100. A fixed single or double cross line is placed at the zero point of the measuring field. The crosslines are all in the focal plane of the eyepiece and appear superimposed on the magnified image.

A comb or scale in the field of view indicates the number of revolutions of the micrometer screw, sometimes an external counter is supplied for this purpose.

Ordinary measurements are made by successively setting the movable crosslines at the opposite ends of the object being measured. The graduated drum can be set to zero at the initial point of measurement. Great precision of measurement can be obtained by using the filar micrometer microscope in conjunction with a standard scale, the microscope serving to subdivide the scale. Since the drum can be graduated to order, and the magnification chose to meet a particular condition, the micrometer microscope is a very convenient method of reading angular scales of any radius.

If p is the pitch of the micrometer screw, n the number of graduations on the drum, and Mo the magnification of the objective in the tube length used, then d, the distance on the object to which each division of the drum corresponds is

$$d = \frac{p}{nMo}$$

Using reasonable care, line settings can be repeated to 0.00001 in. With special precautions higher accuracy is possible. No serious difficulty is experienced in measuring objects down to 0.0001 in. in size, but smaller objects introduce difficulties through diffraction.

A protractor eyepiece is available for measuring angles. This eyepiece has a circle accurately divided in degrees. When rotated, the circle carries with it the 90 deg. crosshairs with which the settings are made. The angular position of the circle is read by a vernier to 3 min. of arc. Delicate rotation is provided by a small pinion which engages the toothed edge of the circle. The crosshairs in this eyepiece are adjustable so that their intersection may be made to coincide with the axis of rotation to any desired degree of accuracy. Linear and angular measurements may be made simultaneously by mounting a scale or filar eyepiece micrometer on the protractor eyepiece.

Suspension of stripper plates

BY JOSEPH S KARASH, RELIANCE ELECTRIC & ENGINEERING COMPANY

Methods of suspending stripper plates and points in favor of interchangeable punches and dies are covered in this section of a die design series

THE USE OF spring operated stripper plates often is unavoidable in designing dies In the case of simple piercing or blanking dies some variation of the stripping schemes suggested in the three previous articles of this series can be utilized to provide the stripping action However, in the case of large dies, particularly those of the compound type, the designer s choice sometimes is limited to some type of spring operated stripper plate When such a stripper is used it is a question whether to use stripper bolts Fig 16*A* or socket head cap screw Fig 16*B*, to suspend the stripper plate

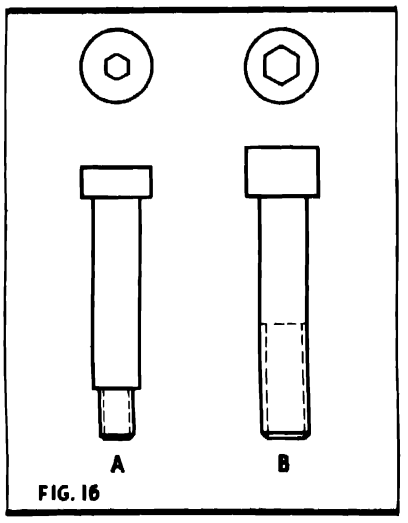


FIG. 16

Fig 16—Stripper plates may be suspended by bolts as at A or by socket-head cap screws B each having certain advantages

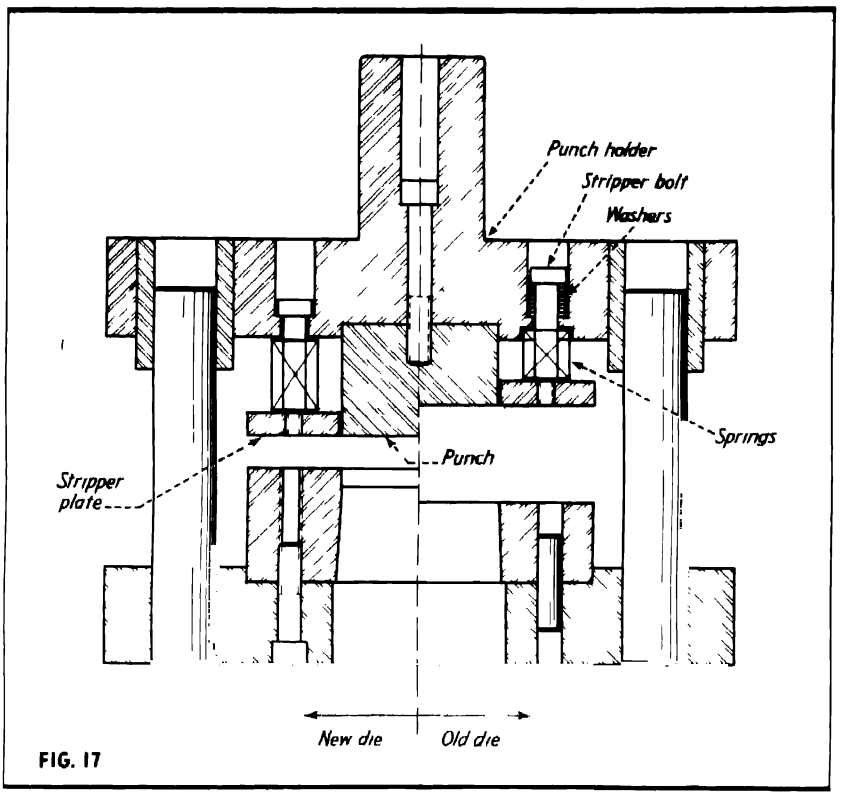


FIG. 17

Fig 17—Stripper bolts are used in this design which is shown as it appears when new and after it has been used and regound several times

In order to clearly illustrate the operating difference between the two methods of plate suspension, let us first analyze just what happens during the life of a die when stripper bolts, Fig 16*A*, are used to provide stripper plate suspension Shown in Fig 17 is a design of this type illustrating the appearance of the die when it is new and how the same die would appear after it has been used considerably It will be noted that

1 The stripper plate must be dismantled and reassembled every time the punch is sharpened

2 In adjusting the stripper plate to keep it flush with the edge of the punch, washers are placed under the heads of the stripper bolts

3 The punch holder periodically must be counterbored to receive the springs

4 A point sometimes is reached when it is necessary to change to shorter bolts to prevent the heads from striking the face of the ram

In Fig 18 is shown the same die with the exception that socket head cap screws are used for suspending the stripper plate By comparing the two it can be concluded that the use of socket head cap screws for plate suspension offers the following

1 The stripper plate does not have to be dismantled in order to grind the punch The stripper plate can be retracted by turning the socket head cap screws as shown at *A* The punch and the end of the socket head cap screws then are ground simultaneously After the grinding operation the socket head cap screws are turned back until the stripper plate is flush with the end of the screws and the edge of the punch The ends of the socket head cap screws are then prick punched to prevent rotation

2 No washers are placed under the socket head cap screws to compensate for punch wear The compensation automatically is taken care of because the ends of the screws are ground at the same time the punch is ground the head remaining at the same level regardless of grinding wear

3 No secondary counterboring is required to receive the stripper springs The longest practical springs are used when first making the die The shortening of the springs usually can be taken up in additional spring preloading In the case of the stripper bolt suspension it would not always be possible to do this because the length of the spring is limited due to the deep counterboring required to provide room for washers

4 It would never be necessary to replace the socket head cap screws with shorter screws since they are ground to a short over all length as the punch is sharpened

A die ready for sharpening on a surface grinding machine is shown in Fig 19 Note that socket head cap screws were used for stripper plate suspension The stripper plate has been retracted to allow the simultaneous grinding of the die and the ends of the socket head cap screws

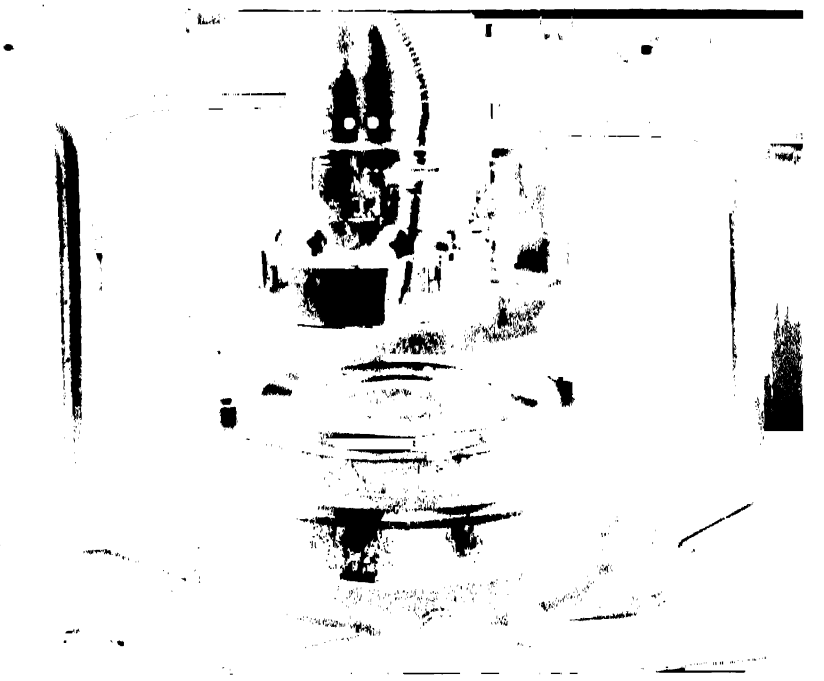


Fig 19 Here the stripper plate has been retracted so that the die and ends of the socket head cap screws can be ground simultaneously

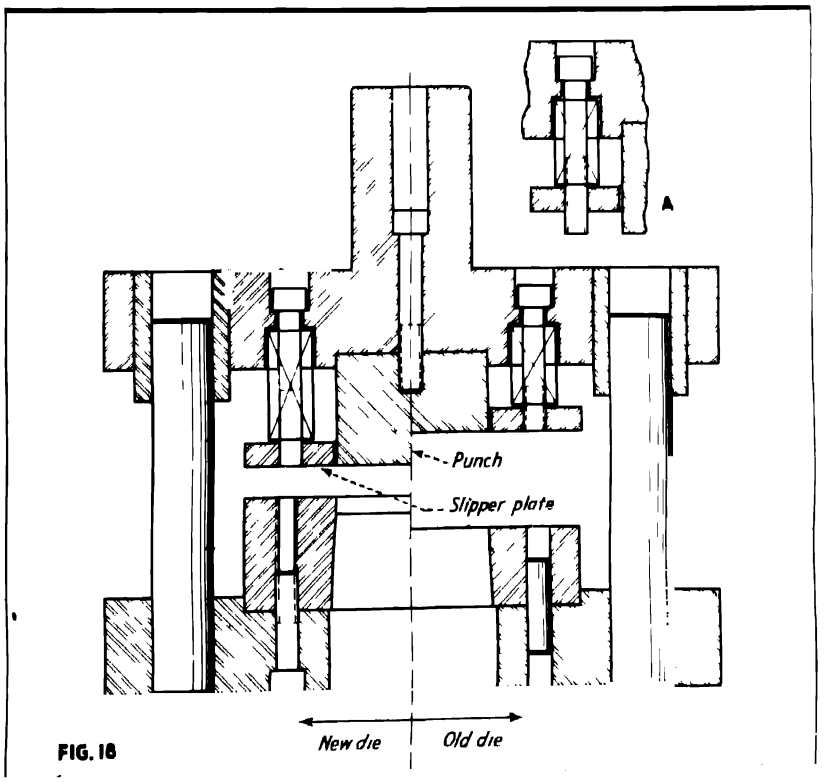


Fig 18—This is the same die as shown in Fig 17 except for the use of socket head cap screws Cap screw is turned down as shown at A and then ground down with the punch

Interchangeable Punches and Dies

The use of interchangeable punches and dies offers possibilities of economy from the standpoint of maintenance cost The advantages to be gained are based on the fact that these punches and dies are removable easily Standardized interchangeable punches and dies are obtainable from a number of concerns The principal difference between the various makes lies in the method used to secure the parts in the die set Shown in Fig 20 is a typical example of a set up using a purchased punch and die with home made punch and die pads From the standpoint of maintenance cost the advantages of such a design are

1 Both the punch and die can be sharpened without removing the punch holder and die shoe from the press

2 Punches and dies can be replaced at very little cost

3 Sharpening can be done on a small grinding machine thus not tying up a larger machine in grinding extremely small parts

4 The punch and die can be replaced to punch a variety of hole sizes in the same die set without disturbing the set up This indirectly reduces

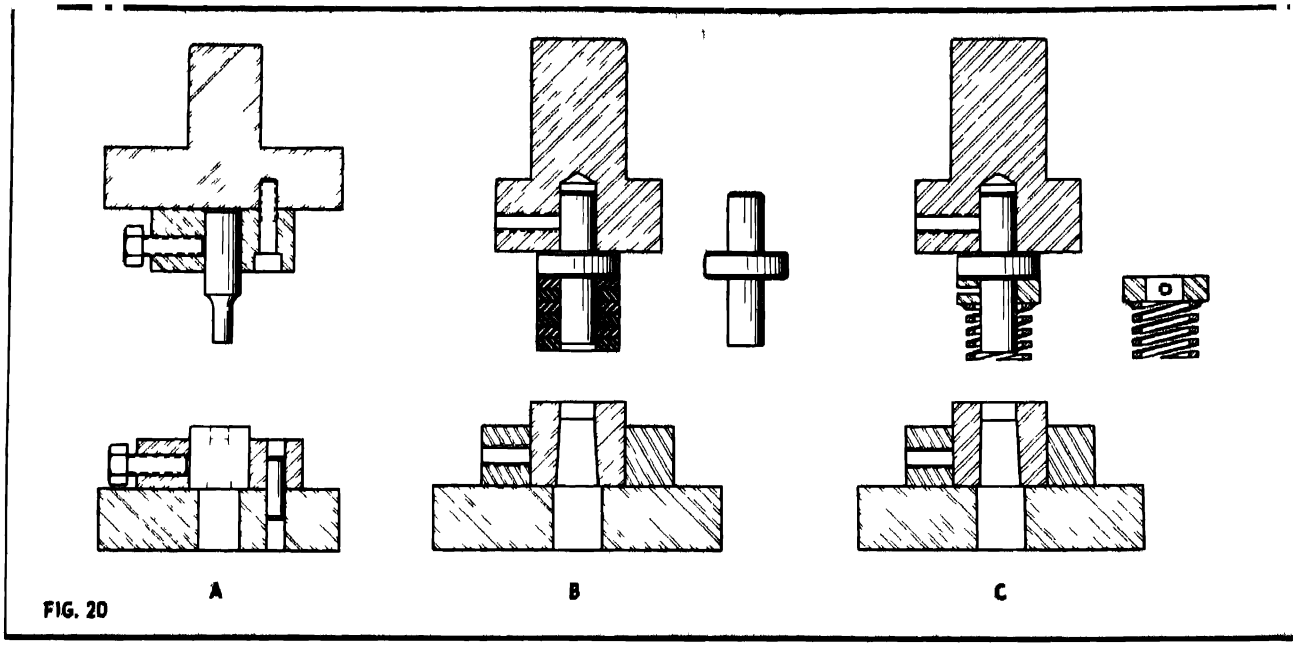


FIG. 20

Fig 20—Interchangeable punches and dies offer many economies because they can be removed readily and, with some ingenuity may be equipped with strippers which improve their performance

maintenance cost because a smaller number of die sets require less handling and less storage space

In using interchangeable punches and dies it sometimes is desirable to use a laminated rubber stripper The type of punch shown in Fig 20*A* is not ideally adapted to this because of the radius on the punch body The rubber stripper would have no shoulder to stop against, and consequently would keep creeping up the body of the punch Designs of interchangeable punches which are adapted to strippers are shown in Figs 20*B* and 20*C* By comparing these two designs to the type shown in Fig 20*A* it can be concluded that they have the following potential advantages

1 The stripping force is exerted against the lower shoulder of the punch and consequently has no tendency to pull the punch out of the punch holder The set screw need only hold the weight of the punch in the holder

2 The punching force is taken on the back of the punch shoulder Consequently, the punch can be held in a drilled hole without the use of a punch pad A pad is necessary when using some types of punches because the force is taken on the back end of the punch The pad is used so that the punch can have a level, hard surface to stand on

3 The punch holder is simple and can be made of a round piece of machine steel with very little machining required

4 The shoulder type of punch is ideal for use with either the laminated rubber stripper or the removable spring stripper thus utilizing the potential advantages of removable stripper, both from the standpoint of maintenance and initial costs

5 In none of the die maintenance schemes shown is there any intention of suggesting methods which are slipshod or haphazard The methods suggested all have their advantages and if applied judiciously should result in a better control of die maintenance cost

Most designers take pride in their work and have a natural tendency to make every design a masterpiece, complete with guide posts and all extras However, it is necessary to recognize the law of economy At times this takes the form of suppression of artistic tendencies in order that the parts can be made economically

Large Repairs in Small Railway Shops

STREAMLINE TRAINS and small railway terminal shops hardly seem to go together But just as another example of the way in which railway shop men handle locomotive maintenance with a lack of facilities, that would stump many in other lines, note the work of the Trascott shop of the Gulf Mobile & Northern railway in Mobile, Ala This is the regular terminal of one 600 hp power unit with a six cylinder McIntosh & Seymour diesel as the motive power, and two other power units come here whenever they need attention —which isn't very often

There is no pit as low elevation above tidewater makes drainage difficult So they built a track that runs the unit high enough to get under to work whenever necessary A few husky timbers and old rails supplied the necessary material

Motor repair, however, is done from the top of the car, through trap doors or hatches For this work the unit is put on a ground level track, and a storage battery mobile crane used to lift cylinder heads, pistons and rods out through the roof

Motors are repaired, or serviced, on the progressive plan When new rings or cylinder liners are needed, they start at one end and repair the first cylinder between runs Then the next cylinder is renewed and the whole engine finished in six days, without missing a single run Rod bearings are also scraped at the same time, when necessary Those in charge state that maintenance costs are less than with steam locomotives, and have largely overcome any doubt as to the reliability of the diesel

Incidentally this same road has found the 2–10–2 freight locomotives built for the old Russian government in about 1918, very efficient as revenue producers

No apprentices?

BY WALTER F. SIMON, SUPERVISOR OF APPRENTICESHIP
INDUSTRIAL COMMISSION OF WISCONSIN

Maybe you haven't the time, the money, nor the inclination to train apprentices. But isn't it your loss as well as theirs?

MANUFACTURING PLANTS can grow old and feeble just like workers. The infirmities of old age are more likely to creep unnoticed upon shops located in small communities, though those in larger centers are not immune.

For lack of new blood and of a training program, many plants are dying on their feet. They are run by veteran superintendents and foremen some of whom haven't had a new idea in twenty years. Worse, nobody can tell these old timers anything new about their jobs. Foreman training classes may help, but isn't this starting at the wrong end of the line?

Some men are able to remain mentally alert all their lives, but too often the opposite is true. It is only natural that we should want to continue doing things as we first learned to do them years ago. Nevertheless, in this swiftly moving age it is fatal to pass the learning stage. Waste and inefficiency always follow.

When I visit one of these aging plants I marvel that it can remain in business. Probably it can keep going on its reputation and on the support of old and faithful customers.

If it can survive despite inefficient personnel and antiquated production methods it certainly has capacity for growth. It has a running start on all newcomers. Actually, some of these concerns are in a most advantageous position, but the management doesn't seem to realize it. Bring in some up and coming young men, put them through a modern apprenticeship program, and these old established shops could show their heels to some of the newer and less stable organizations.

Then there are the younger shops which, when they do operate, are always so busy they have no room, no time, no inclination to employ apprentices. They simply can't be bothered about training anybody. While local boys would gladly give anything to learn a trade, and while many able bodied men are on relief, these concerns find it most expedient to bring in skilled men from outside. This often means that outsiders bring in trouble with them.

Another common type of shop is the one which employs learners instead of apprentices, although the management resents the inference that the learners are not in fact apprentices. Investigation usually discloses the arrangement to be a one sided affair. There is no written agreement which means that the employer assumes no obligation to train the boy. Dismissal can occur any time with or without cause. There is no definite understanding as to when the term of apprenticeship is completed, no agreement covering periodic wage increases, no promise to shift the learner from one machine or operation to another.



A piece-work crazy learner rarely develops into a competent machinist

Proportionately few of these learners ever develop into competent mechanics. The reason is obvious. As the learner becomes efficient on one machine he begins to earn a fairly good wage. He may even become piece work crazy, as one plant apprentice supervisor puts it. Earning good money and lacking judgment, he wants to stay where he is. As his production increases, his employer also is satisfied to keep him where he is, and that makes it unanimous. But in the end the employer must pay a penalty. He has a shop full of machine operators and practically no mechanics.

It is indeed disgraceful to have on one hand an unprecedented number of unemployed young people and on the other an ever increasing scarcity of skilled men. Is any wonder that the youth movement is gaining momentum? It is a cock eyed condition to which business men might well give attention. In the last analysis what do young people want except a job and such practical training as will enable them to become self supporting? Since only industry can supply this demand, the least industry can do is to examine the feasibility of more widespread youth training.

Often we hear it said that state and federal laws make it difficult to hire apprentices. Yes, if one desires to employ boys fourteen or fifteen years old and pay them next to nothing, then trouble will be encountered in some states. But let's be reasonable. That difficulty won't apply to a bona fide 1940 model apprenticeship system based on experience and not on something we read in books.

State apprenticeship laws cannot be classed as detrimental to apprentice training. Only nine states have such legislation, and in each case it is voluntary in application. None requires the employer to enter into an agreement with his apprentices. None specifies an hourly or weekly wage rate. None determines the ratio or number of apprentices. None attempts to tell the employer what he shall teach his apprentices. In short, these laws simply set up certain recommended minimum standards.

Let me repeat, these are voluntary standards. The employer has a choice of using or disregarding them, or of not employing any apprentices at all.

Many consider the federal Wages

and Hours Act as the country's No. 1 apprenticeship "restricter." But the facts do not support this belief. The administrator of the law has ruled that apprentices may be employed at a beginning wage of less than 30 cents an hour provided the standard established by the Federal Committee on Apprenticeship be met and that a special exemption be secured from the Wage and Hour Division for each apprentice.

The four standards referred to are:

1. There must be a written agreement between apprentice and employer. This is nothing new. Centuries before Columbus discovered America there was an agreement of that kind in every apprenticeship. The principles of apprenticeship have not changed any more than has human nature. When an employer, acting in good faith, promises a boy an opportunity to learn a trade, why should he hesitate to put the promise in writing? Federal standards say that the agreement must contain statements as to term of training, schedule of processes or divisions of the trade to be taught, amount of part-time school attendance, and the scale of wages.

2. Apprentice wages must be based on the prevailing skilled rate in the same trade and community. The requirement is that in the course of his term the apprentice be paid an amount equal to half that earned by the skilled worker during the same period.

3. The apprentice must attend a public school 144 hours per year or a total of 576 hours in a four year term. Lately there has been a modification of this requirement. The recommendations now provide simply that there shall be "adequate" supplemental related instruction but that 144 hours per year is "desirable." Classroom instruction consists of related technical information such as shop mathematics, drawing, blue-print reading and other subjects to enable the apprentice to develop into a competent mechanic The employer is not compelled to pay for time so spent. Furthermore, the employer is not prevented from cooperating with the school to see that his apprentices get the kind of instruction needed. Incidentally, in industries and communities which for years have sent apprentices to school part-time, an apprentice in his third year knows more about the theory of his trade than most of the mechanics with whom he works. The employer even mildly interested in the welfare of his apprentices will find no reason to object to this schooling. After all, he benefits from it too.

4. A schedule of training must cover the parts of the trade to be learned. The standards do *not* lay down any hard and fast rules in this respect, nor do they prescribe particular schedules. To become a machinist, for example, the apprentice must master the operation of about eight basic machines common to every machine shop. The standards require the agreement to specify those machines and the approximate time to be spent on each. If the agreement says six months shall be spent on lathes, it means six months' experience on lathes in the course of the term of training- not six consecutive months. The schedule can be varied to suit the particular shop.

To secure the exemption necessary to employ the apprentice at less than 30 cents an hour, copies of the agreement together with an application must be sent to the Hearings Branch of the Wage and Hour Division. If the standards previously mentioned have been observed, the exemption is a matter of a few days' time.

Worth 30 Cents an Hour

If an apprentice is paid 30 cents an hour, an employer need not concern himself about federal apprenticeship requirements. Actually, a bona-fide apprentice is worth that amount as a beginner. In Wisconsin, for example, about 1,300 apprentices are under agreement in the metal trades. The beginning rate is 30 cents an hour or more, and this is a voluntarily paid wage which was in effect before the Wages and Hours Act. Our employers are no more and no less charitable than those in other states and we must assume, therefore, that they consider the wages paid apprentices a reasonable rate. All Wisconsin agreements meet federal apprenticeship standards and exceed them in some respects. For example, the apprentices are paid full wages for time spent in school.

Somebody might rise to say, "Yes, but that is one of the requirements under your apprenticeship law." True enough, but remember that the law is voluntary in application. The employer need not enter into agreement with his apprentices if he does not see fit. But the fact remains that we have 1,300 agreements in the metal trades alone. Furthermore, apprentices are sent to school not merely 144 hours a year or 576 in four years—records of 800 to 1,000 hours' attendance on full pay are made almost daily. Lately one employer graduated two toolmaker apprentices with records of 1,087 and 1,137 hours of schooling. Both boys, after serving the standard four-year terms, turned around and signed another two-year agreement for a sort of post-graduate course in tool estimating at a beginning wage of 65 cents an hour. This means more school attendance, too. Upon graduating, these boys will have acquired training and experience such as no school in the world can provide. At the same time, the employer will have men he needs and can get in no other way.

Employers will do well to use services of the Federal Committee on Apprenticeship. This agency is prepared to offer whatever assistance is needed to inaugurate a training system. It will send, free of charge and with no strings attached, sample agreements and all the necessary technical information. It can advise whether any state organizations have been set up to promote apprenticeship. Should an employer see fit not to use any of the literature or advice offered by this agency, that's his privilege.

What about child labor legislation? Since the apprentice will be a high school graduate, he will be about eighteen years of age and therefore the usual prohibited employments are not likely to apply to him. As for restrictions on hours of labor, it is not logical that any employer would expect his apprentices to work longer hours than other employees. In the manufacturing industries the work week is well below the maximum set by state laws.

Workmen's compensation laws apply alike to apprentices and other workers.

Unemployment compensation laws operate in favor of apprenticeship. The man whose experience is limited to only one or two machines naturally is one of the first to be laid off when work slows down. The man who has served an apprenticeship and has acquired all-round training and experience can easily be shifted to a variety of jobs and thus retained in employment for a longer period.

Instead of laws which might be construed as detrimental to the employment of bona fide apprentices, there is an astonishing scarcity of laws designed to protect the interests of potential apprentices. In other words, boys wishing to learn trades are the ones entitled to do the crying.

Do the unions oppose apprenticeship? The answer depends on the kind of apprenticeship the employer attempts to promote. If he refuses to sign apprenticeship agreements, if he tries to employ boys at low wages without at the same time furnishing the kind of training the apprentices have a right to expect, then the unions object and rightfully so. But if the employer acts in good faith, he will

find the unions ready to meet him half way

Mention was made of 1 300 metal trades apprentices under agreement in Wisconsin To the best of my knowledge, every one is employed in shops organized by either the C I O or the A F of L Not a single shop in the state is employing as many apprentices as the working agreement between the management and the union permits Isn't that sufficient evidence to prove that the unions are more liberal in this respect than they need be? The employers too are liberal in that they employ no more apprentices than the industry can absorb However those apprenticeships which are in force are all genuine and therefore organized labor lends its wholehearted support

What happens to apprentices when a reduction in working force becomes necessary? Since the tendency is to spread the work among as many men as possible rather than lay anybody off the apprentice simply takes his medicine with the rest of the employees If the work week is reduced to four days then the apprentice also works four days which will extend his apprenticeship period proportionally

The apprenticeship problem must be approached with an open mind What complicates matters is the fact that many men in supervisory positions have never served a genuine apprenticeship This is illustrated when an employer argues that his mechanics and foremen cannot take time to instruct apprentices I served an 11,000 hour apprenticeship in patternmaking and do not hesitate to say that what I learned from journeymen and foremen I could put in my eye and never notice Apprentices learn by doing and not by watching or being told Again an employer may say an apprenticeship system is too expensive The truth is that in a four year term the apprentice will earn a satisfactory profit for his employer

The care used in selecting applicants largely determines the success of an apprenticeship program So called vocational guidance has little connection with this problem Apprentices should not be selected on the basis of past experience acquired in some other shop or in some trade school In judging applicants the employer should keep this question in mind What qualities does this fellow possess which will make him valuable to my organization ten or fifteen years from now?

Good character is of first importance A likeable personality is necessary The apprentice who cannot get along with those around him is sunk before he begins Has he the initiative to go ahead without continually asking for instructions? Is he trustworthy? Can he readily understand orders? Is he willing to assume responsibility? Is he physically fit?

These qualifications should be carefully examined No employer can expect a perfect score in this respect but there is always a three or four month probationary period

Educational entrance requirements should be high school graduation or better An oral examination will eliminate 75 per cent of the applicants and a written test will tell the rest of the story

Where to find applicants? Even a rumor of a genuine opportunity to learn a trade will bring a flock of applicants There are so many well qualified young fellows looking for work that the employer could set the entrance requirements sky high and still get all the boys he could use

While mapping out a training plan may involve a few technicalities there is nothing particularly difficult about it Almost every manufacturing plant needs better mechanics better supervisory staff and better salesmen who know the company's product from the ground up The basic training should be the same for all three classifications It should be as diversified and at the same time as thorough as the plant's facilities will permit Some boys will not have the ability nor the desire to be more than skilled mechanics In four years time all their qualities will come to the surface If any have a sense of leadership and ability to carry responsibility they will clearly demonstrate their capabilities

Speaking of leadership it is the one thing the apprenticeship movement lacks There is need for such leadership among educators trade unions industrial management yes and in the government itself From the standpoint of national defense in this regard the lack of foresight displayed by the government is nothing short of dismaying Warfare today is on a mechanized footing as is so plainly being demonstrated in Europe Not only must there be plenty of mechanics to build the tools of war but mechanical training is rapidly becoming part of the individual soldier's preparation for effective service

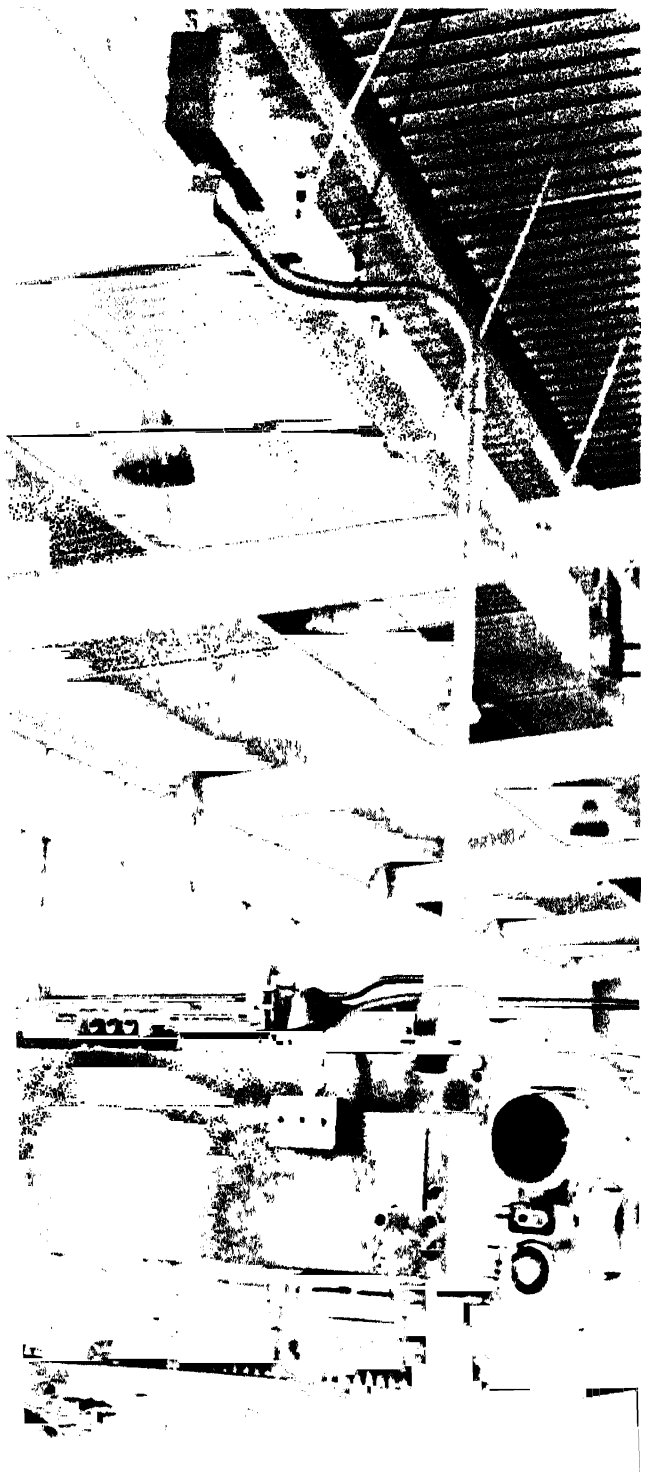
During this national emergency we shall see all sorts of hare brained schemes advanced for the training of highly skilled men We probably shall see millions of dollars and much precious time wasted until the government learns how to coordinate its efforts in solving this problem Most of the plans now under consideration may help to produce semi skilled workers but there is no known short cut system of producing toolmakers patternmakers and other craftsmen Must we therefore wait three or four years before we can create a toolmaker? Yes if we want toolmakers But remember that properly selected supervised and trained apprentices begin producing almost immediately That being the case we might just as well make each apprenticeship a genuine one If we do that we shall have a mighty useful program left us long after the emergency has passed



Even a rumor of a chance to learn a trade will bring a flock of applicants

Shop Shots

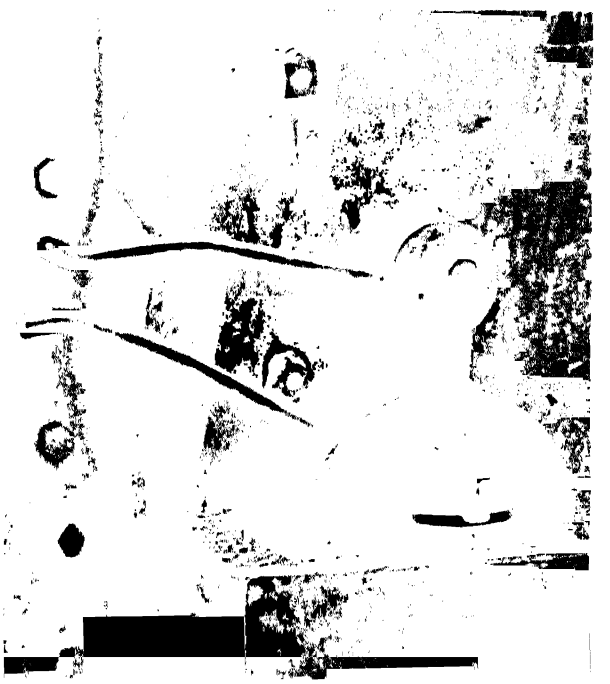
In shearing departments machine operators generally require three types of service, so a signal system using three different colored tubular lights was devised On the press are three switches, each connected to an individual light on the roof truss. The top (red) light indicates that the operator wants the truck, the center (white) light indicates that the foreman is wanted, while the lower (green) light indicates that the crane or steel handler is needed Courtesy A. F. Frickson, works manager, All-Steel-Equip Company





Getting good lighting on dies in a press is often difficult One solution is effected by placing a fluorescent tube inside each column of the press The protecting wire screen slides in and out of a sheet-metal frame for easy servicing Courtesy A F. Frickson, All Steel Equip Company

Trouble with warping is often experienced in quenching thin steel disks Since the quantity involved at any one time may be too small to warrant special equipment, this simple clamp was devised for holding a 3 16-in steel disk while being quenched The upper spider is held against the disk by a cam and lever, which when released allows the plunger to be pulled up by a coil spring A ball bearing welded to the end of the plunger is held by fingers on the spider so that it can tilt slightly and allow for inequalities in the disk Courtesy W. A. Butterworth, Barnes Drill Company



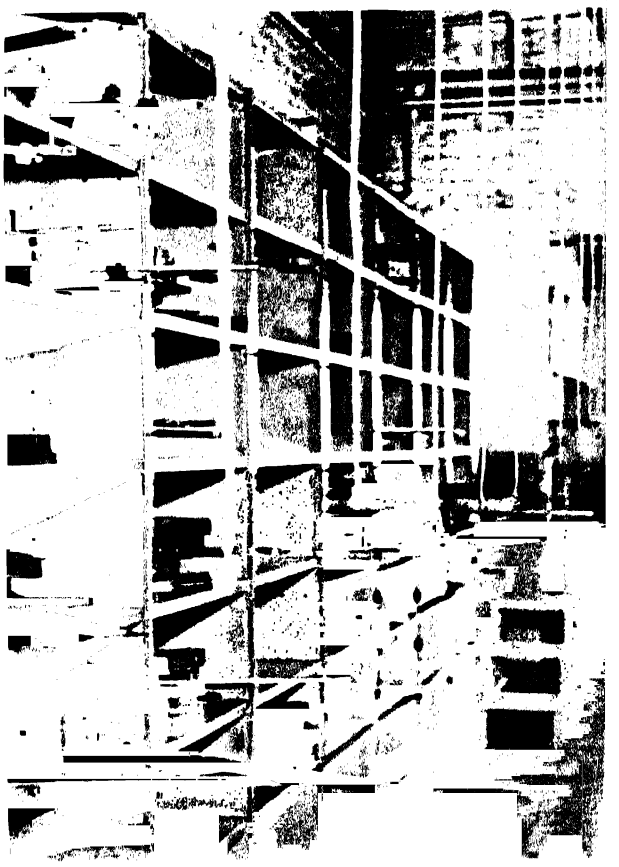




This portable scale is made into a floor scale by placing it into a concrete-lined pit. The scale is held in place and the pit kept covered by a collar of welded ¼-in. steel plate. Another shallow pit alongside the scale makes it possible to transfer parts to stacking boxes with minimum lifting. Boxes rest on rollers in the bottom of a carrier which hangs from the chain hoist. An overhead monorail leads to the shelves where the stacking boxes are kept, right. Hoist and rollers in the carrier make it easy to move boxes in and out, while flared lips on the boxes make them easy to stack. The monorail extends over the scale so that it can easily be lifted from the pit. Courtesy George A. Horton, All-Steel-Equip Company



Radial drills are equipped with convenient plunger-type oilers to provide controlled amounts of lubricant for drilling, reaming or tapping holes in engine blocks. A welded sheet metal oil reservoir is mounted on the drill head. Courtesy Caterpillar Tractor Company



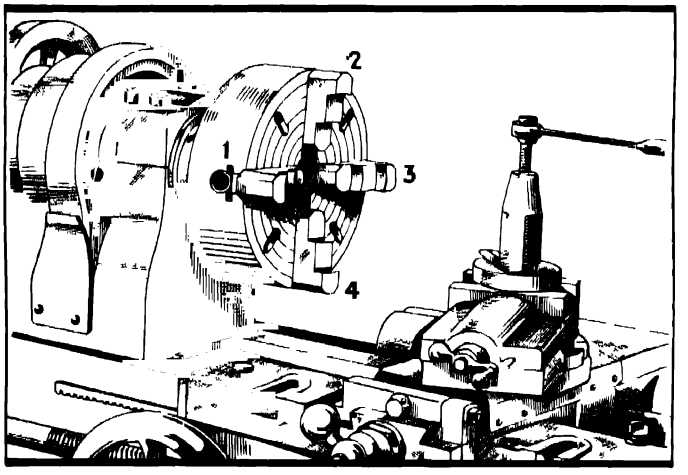
Many railroad men will recognize this one. Dies and other odd-shaped parts are stored in racks alongside walkways between two departments. When someone walks too near the extended steel pieces he brushes against a row of ropes suspended from the ceiling as a warning. Courtesy A. F. Erickson, All-Steel-Equip Company

IDEAS FROM PRACTICAL MEN

Rapid Centering a Four-Jaw Chuck

By STANLEY W WORTHINGTON

Many mechanics do not like to use the independent four jaw chuck because of the time needed to center the work If a definite routine is followed in centering the work rapid and positive adjustment is possible



Work can be centered quickly in the independent four jaw chuck by using two keys and following the author's procedure for adjusting the jaws

I have found that the best routine to follow is the one explained below

First catch the work in a pair of opposite jaws Nos 1 and 3 in the illustration

Second, adjust jaws Nos 2 and 4 until they touch the work lightly

Third using two keys at the same time for jaws Nos 1 and 3 loosen one and tighten the other so as to move the work in the desired direction without having it drop out of the chuck

Fourth revolve the chuck one quarter of a turn tighten jaws Nos 2 and 4 and loosen No 1 slightly

Fifth using two keys in jaws Nos 2 and 4 loosen one and tighten the other to move the work in the desired direction

Sixth tighten jaw No 1

Rough center the work first by eye bringing the punch mark or center hole as nearly opposite the dead center as possible and then make the fine adjustment with the test indicator When using the indicator always test opposite points first using two keys to move the work half the apparent error following the steps in order given above That is with the chuck arranged as shown in the illustration adjust the test indicator against the work near jaw No 1 until the needle reads zero Revolve the chuck a half turn and read the dial when jaw No 3 is near the indicator Loosen jaw No 1 very slightly Using two keys in jaws Nos 1 and 3 loosen one and tighten the other so as to move the work half the error

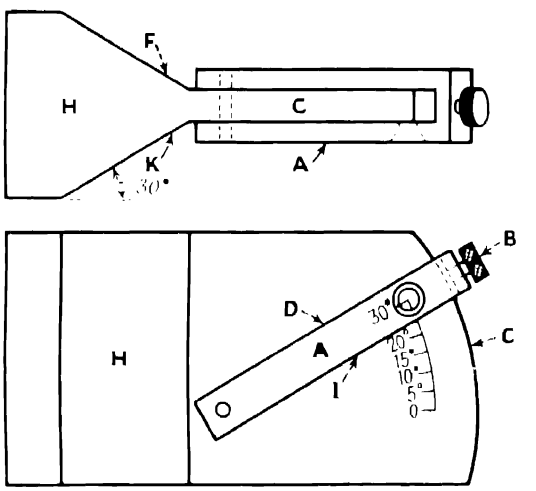
Tighten jaw No 1 Revolve the chuck one quarter turn so that jaw No 1 is on top and loosen it very slightly Using two keys now adjust jaws Nos 2 and 4 in the same manner as was done with jaws Nos 1 and 3 Finish by tightening jaw No 1

Grinding Correct Angles on Threading Tools

By G O HALL JR

The device illustrated is for gaging the cutting angles of threading toolbits that are tipped up at an angle in the toolholders It is obvious that if a toolbit is ground to an included angle of 60 deg and is then put in a holder that tilts it at an angle the angle of the thread it will cut will not be correct By using the device described here the toolbit can be ground to correct that error

In operation the pivoted arm *I* is set to the angle at which the toolbit is tipped up in the toolholder and is locked by the knurled head screw *B* The toolbit is laid flat on the graduated plate *C* with its upper edge in contact with the side *D* of the pivoted arm and is slid along it until one side of the cutting edge contacts side *J* of the angular plate *H* The toolbit is then ground so that side of its cutting edge fits the gage The opposite side of the cutting edge is gaged by lay



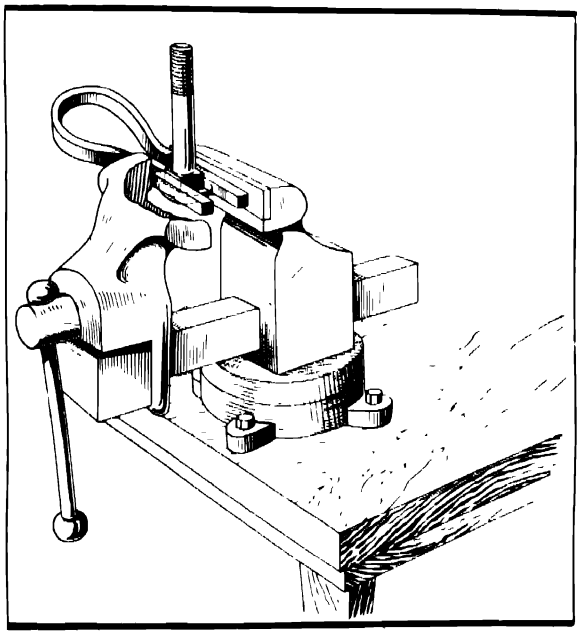
This device shows how to grind the correct angle on a threading tool when it is tilted in the tool holder during the thread cutting operation

ing the toolbit flat on plate *C* with its upper edge in contact with side *I* of the pivoted arm and is slid along until its cutting edge contacts the angular surface *K* of plate *H*. That side is then ground to fit the gage. After both cutting edges have been ground to fit the gage, it will cut a thread having an included angle of 60 deg. when it is tipped in the toolholder. It goes without saying that when the toolbit is in the toolholder, its top at the cutting end must be ground so as to be parallel with the cross-slide when set in the lathe.

How to Hold Carriage Bolts in the Vise

By WILLIAM A. SPELLMAN

Sometimes it is necessary either to run a die over the damaged threads or to cut more threads farther on carriage bolts having squares under their heads



In repairing damaged threads on carriage bolts, this spring yoke will permit them to be held in the vise without damage to the heads

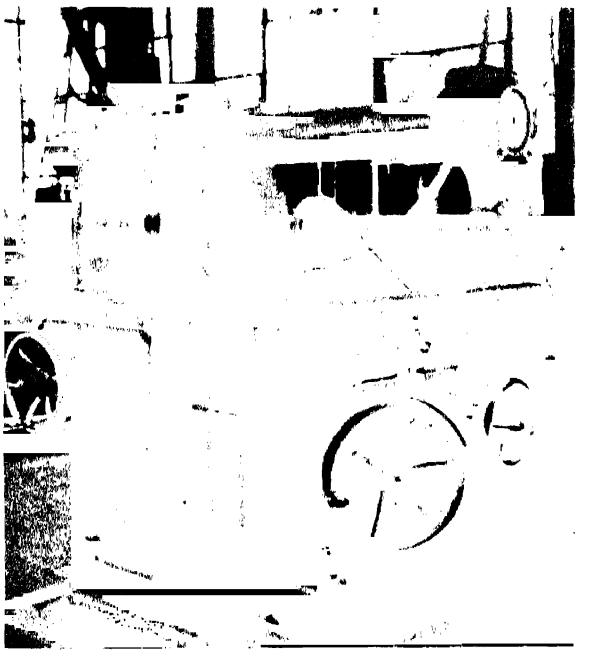
The only difficulty is holding the bolts in the vise without damaging the thin edges of the heads.

If a piece of $\frac{5}{16}$-in. key stock is bent into the shape of a jew's-harp, the ends can be sprung over the square of the bolt and the bolt can be held in the vise without injuring the head, as shown in the sketch. The threads can then be cut as close to the squares as the die will permit.

Rolling T-Section Bars on a Miller

By FRED H. COLVIN

A husky milling machine stands a lot of grief even when it is used on the work it was designed for. Used as a rolling mill for T-section steel is another



Rather than buy a bending roll, this LeBlond Miller was pressed into service to roll 6-ft. diameter rings for electric-sign frames

matter, it can be done if proper tools are used.

The No. 4 LeBlond miller shown is in the shop of the Bayliss Machine Co. in Birmingham, Ala. They make quite a lot of 6-ft rings for the frame work of electric signs. These are about 2-in. T-section steel and are rolled up as shown. A large grooved roller on the arbor guides the T-bar and also curves it as the supporting rollers on the table are forced up by the knee. These rollers are held between angels as shown. These can be spaced differently as indicated by the holes. After bending to shape the ends are welded.

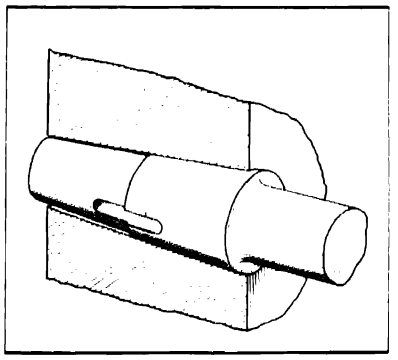
Relieved Piston-Rods Avoid Breakage

By FRANK C. HUDSON

Piston rod breakage is frequently a serious problem on many railroads. The breaks usually occur near the keyway in the crosshead end. One southern railroad shop executive has adopted a practice which he feels is responsible for the elimination of breakage in every rod fitted by the new method. The remedy is very simple, and has worked in every case so far tried.

Instead of trying to secure a fit the whole length of the taper, the half toward the small end is turned down somewhat. This may average $\frac{3}{64}$ to $\frac{1}{16}$ in. although the exact amount is said not to be important. The object is to have the entire bearing surface on the large end of the taper, as indicated in the illustration.

The theory of this relief at the small end is that the driving in of the key spreads or swells the small end. When the small end fits, this puts the bearing on that end and leaves the large end free to "weave" in the crosshead and causes the cracks that start near the front end of the key slot. According to records,



Piston-rod taper relieved as shown, assures a tight fit on the large end. Thus the large end will not weave in the crosshead, thereby eliminating one of the causes of crack propagation in piston rods

the method described, has eliminated piston rod breakage at this point. This procedure has been adopted on the railroad in question.

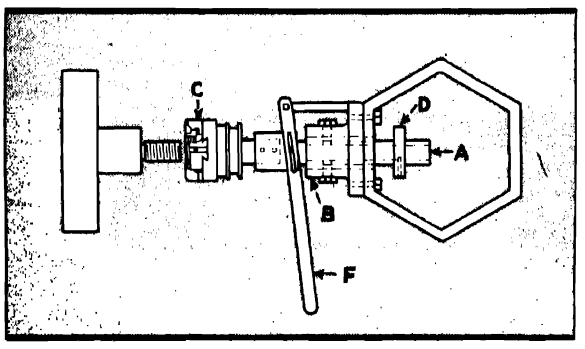
Piston rods are also relieved at the points where the rod packing contact ends. A relief of perhaps 3 in. is turned or ground slightly below normal diameter so that part of the packing rides over the edge of the relief. This prevents the formation of shoulders at the end of the rod travel.

Attachment for Cutting Fine Threads

By A. A. LEONHARDI

The attachment illustrated is for cutting fine threads on work of small diameter in large turret lathes where the movement of the heavy saddle-mounted turret is not sensitive enough for the operator to feel the correct pressure that should be applied in starting the die on the work.

Essentially the device consists of the bar *A* fitted to slide in the bushed boss *B* on one of the turret faces,



The heavy saddle-mounted type of turret lathe is not adapted for cutting fine threads on small work, but with this sensitive attachment such threads can easily be cut

and carrying the self-opening die-head *C* on its outer end and the stop collar *D* near its inner end; and the lever *F* for advancing and retracting the die to and from the work.

In operation, the stop collar is set for the length of the thread to be cut and the die-head is advanced to the work by the operating lever and cuts the thread. After the thread has been cut and the stop collar contacts the inner face of the hollow turret, further advancement of the die is arrested. The die-head then opens and is drawn back to the starting point by the operating lever.

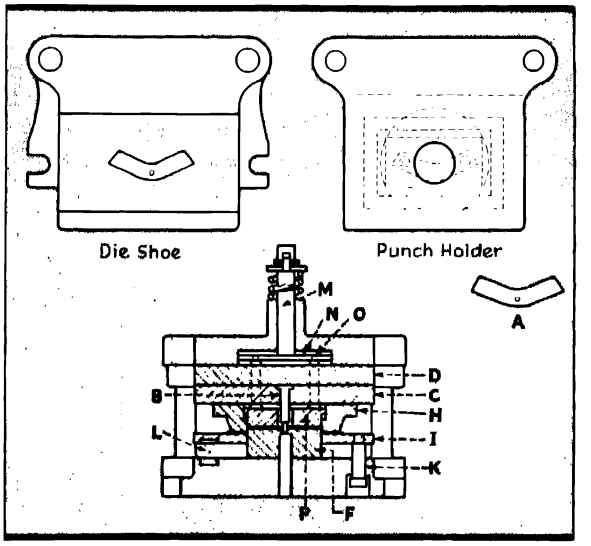
The device is very sensitive and threads can be cut on work of small diameter with it just as easy as in a small ram-type screw machine.

Press Tools for Piercing and Blanking

By WILLIAM B. GREENER

The press tools illustrated were designed for piercing and blanking a large quantity of parts such as the one at *A* from scrap stock.

The tools are mounted in a standard die set and consist of the piercing punch *B* which is inserted in plate *C* and is backed up by plate *D*; the blanking punch F which is mounted on the die shoe and also serves as the piercing die; the blanking die *H* which is attached to the punch holder; the stripper *I* which is



Small parts can often be made from scrap left from blanking larger parts. The work can be done economically by these comparatively simple press tools

guided by the shoulder screws *K* and is operated by springs at *L*; and the knockout *M* which is operated by plate *N* and the pins *O* which are attached to the shedder *P*.

In operation, the scrap stock is placed on the blanking punch. As the ram descends the part is pierced. As the ram continues its descent and nears the bottom of its stroke the part is blanked by the blanking punch as the blanking die passes over it. On the upward stroke of the ram the stripper is forced upward by the springs and strips the waste stock from the blanking punch. The knockout is operated by the knockout bar on the press through pins on the shedder and pushes the part out of the blanking die.

Weights of Metric Steel Sizes in English Units

BY HUGH S CAMERON

CONVERSION TABLE FOR ROUND, SQUARE, AND HEXAGONAL STOCK

Dimension "a"		Round		Square		Hexagon	
mm	in	kg m	lb/ft	kg m	lb ft	kg m	lb ft
5	0 197	0 154	0 103	0 196	0 132	0 170	0 114
6	0 236	0 222	0 149	0 283	0 190	0 245	0 165
7	0 276	0 302	0 203	0 385	0 259	0 333	0 224
8	0 315	0 395	0 265	0 502	0 337	0 435	0 292
9	0 354	0 499	0 335	0 636	0 427	0 551	0 370
10	0 394	0 617	0 415	0 785	0 528	0 680	0 457
11	0 433	0 746	0 501	0 950	0 638	0 823	0 553
12	0 472	0 888	0 597	1 13	0 759	0 979	0 658
13	0 512	1 04	0 699	1 33	0 894	1 15	0 773
14	0 551	1 21	0 813	1 54	1 035	1 33	0 894
15	0 591	1 39	0 934	1 77	1 189	1 53	1 028
16	0 630	1 58	1 062	2 01	1 351	1 74	1 169
17	0 669	1 78	1 196	2 27	1 525	1 96	1 317
18	0 709	2 00	1 344	2 54	1 707	2 20	1 478
19	0 748	2 23	1 499	2 83	1 902	2 45	1 646
20	0 787	2 47	1 660	3 14	2 110	2 72	1 828
21	0 827	2 72	1 828	3 46	2 325	3 00	2 016
22	0 866	2 98	2 003	3 80	2 554	3 29	2 211
23	0 906	3 26	2 191	4 15	2 789	3 59	2 412
24	0 945	3 55	2 386	4 52	3 037	3 92	2 634
25	0 984	3 85	2 587	4 91	3 300	4 25	2 856
26	1 024	4 17	2 802	5 31	3 568	4 60	3 091
27	1 063	4 50	3 024	5 72	3 844	4 96	3 333
28	1 102	4 83	3 246	6 15	4 133	5 33	3 582
30	1 181	5 55	3 730	7 07	4 751	6 12	4 113
32	1 260	6 31	4 240	8 04	5 403	6 96	4 677
33	1 299	6 71	4 509	8 55	5 746	7 10	4 973
34	1 339	7 13	4 791	9 07	6 095	7 86	5 282
35	1 378	7 55	5 074	9 62	6 465	8 32	5 591
36	1 417	7 99	5 369	10 2	6 854	8 81	5 920
38	1 496	8 90	5 981	11 3	7 594	9 82	6 599
40	1 575	9 87	6 633	12 6	8 467	10 9	7 325
41	1 614	10 3	6 922	13 2	8 870	11 4	7 661
42	1 654	10 9	7 325	13 9	9 341	12 0	8 064
45	1 772	12 5	8 400	15 9	10 69	13 8	9 274
46	1 811	13 0	8 736	16 6	11 16	14 4	9 677
48	1 890	14 2	9 542	18 1	12 16	15 7	10 55
50	1 969	15 4	10 35	19 6	13 17	17 0	11 42
53	2 087	17 3	11 63	22 1	14 85	19 1	12 84
55	2 165	18 7	12 57	23 8	15 99	20 6	13 84
56	2 283	20 7	13 91	26 4	17 74	22 8	15 32
60	2 362	22 2	14 92	28 3	19 02	24 5	16 46
63	2 480	24 5	16 46	31 2	20 97	27 0	18 14
65	2 559	26 0	17 47	33 2	22 31	28 7	19 29
68	2 677	28 5	19 15	36 3	24 39	31 4	21 10
70	2 756	30 2	20 29	38 5	25 87	33 3	22 38
73	2 874	32 9	22 11	41 8	28 09	36 3	24 39
75	2 953	34 7	23 32	44 2	29 70	38 2	25 67
78	3 071	37 5	25 20	47 8	32 12	41 4	27 82
80	3 150	39 5	26 54	50 2	33 73	43 5	29 23
83	3 268	42 5	28 56	54 1	36 36	46 9	31 52
85	3 346	44 5	29 90	56 7	38 10	49 1	32 99
90	3 543	49 9	33 53	63 6	42 74	55 1	37 03
95	3 740	55 6	37 36	70 9	47 65	61 4	41 26
100	3 937	61 7	41 46	78 5	52 75	68 0	45 70

MANY AMERICAN FIRMS are receiving foreign orders for steel the specifications for which are in metric units Since American prices and shipping weights are based on weights expressed in English units metric weights of the metric steel sizes must be converted into English units This is often a tedious task To facilitate converting metric weights and sizes into English units, the following tables have been prepared to determine (1) the weight in pounds per foot of metric steel sizes, and (2) that steel size in English units nearest the steel sizes specified in metric units The values in the tables are based on the specific weight of steel = 7 85 kilograms per cubic decimeter = 490 lb per cu ft, and 1 kilogram per meter = 0 672 lb per ft

One of the tables gives the weights of round, square and hexagonal steel bars The metric dimensions in millimeters and weights in kilograms per meter are given together with the corresponding English dimensions in inches and weights in pounds per foot For example a 23 mm hexagonal bar weighs 3 59 kilograms per meter which is equivalent to 2 412 lb per ft the width across the flats is 0 906 in

The table on page 547 gives the weights of flat plates in different widths and thicknesses Metric sizes and weights are given together with their English equivalents For example the weight in English units of a 32x25 mm plate weighing 6 28 kilograms per meter is 4 220 lb per ft the size is 1 299 0 984 in

Dimension "a"		Round		Square	
mm	in	kg m	lb ft	kg m	lb ft
105	4 134	68 0	45 70	86 6	58 20
110	4 331	74 6	50 13	95 0	63 84
115	4 528	81 5	54 77	104	69 89
120	4 724	88 8	59 67	113	75 94
125	4 921	96 3	64 71	123	82 66
130	5 118	104	69 89	133	89 38
135	5 315	112	75 26	143	96 10
140	5 512	121	81 31	154	103 5
145	5 709	130	87 36	165	110 9
150	5 906	139	93 41	177	118 9
160	6 299	158	106 2	201	135 1
170	6 693	178	119 6	227	152 5
180	7 087	200	134 4	254	170 7
190	7 480	223	149 9	283	190 2
200	7 874	247	166 0	314	211 0
210	8 268	272	182 8	346	232 5
220	8 661	298	200 3	380	255 4
230	9 055	326	219 1	415	278 9
240	9 449	355	238 6	452	303 7
250	9 843	385	258 7	491	329 9

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NEW DEPARTURE

THE FORGED STEEL BEARING

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Weights of Metric Steel Sizes in English Units

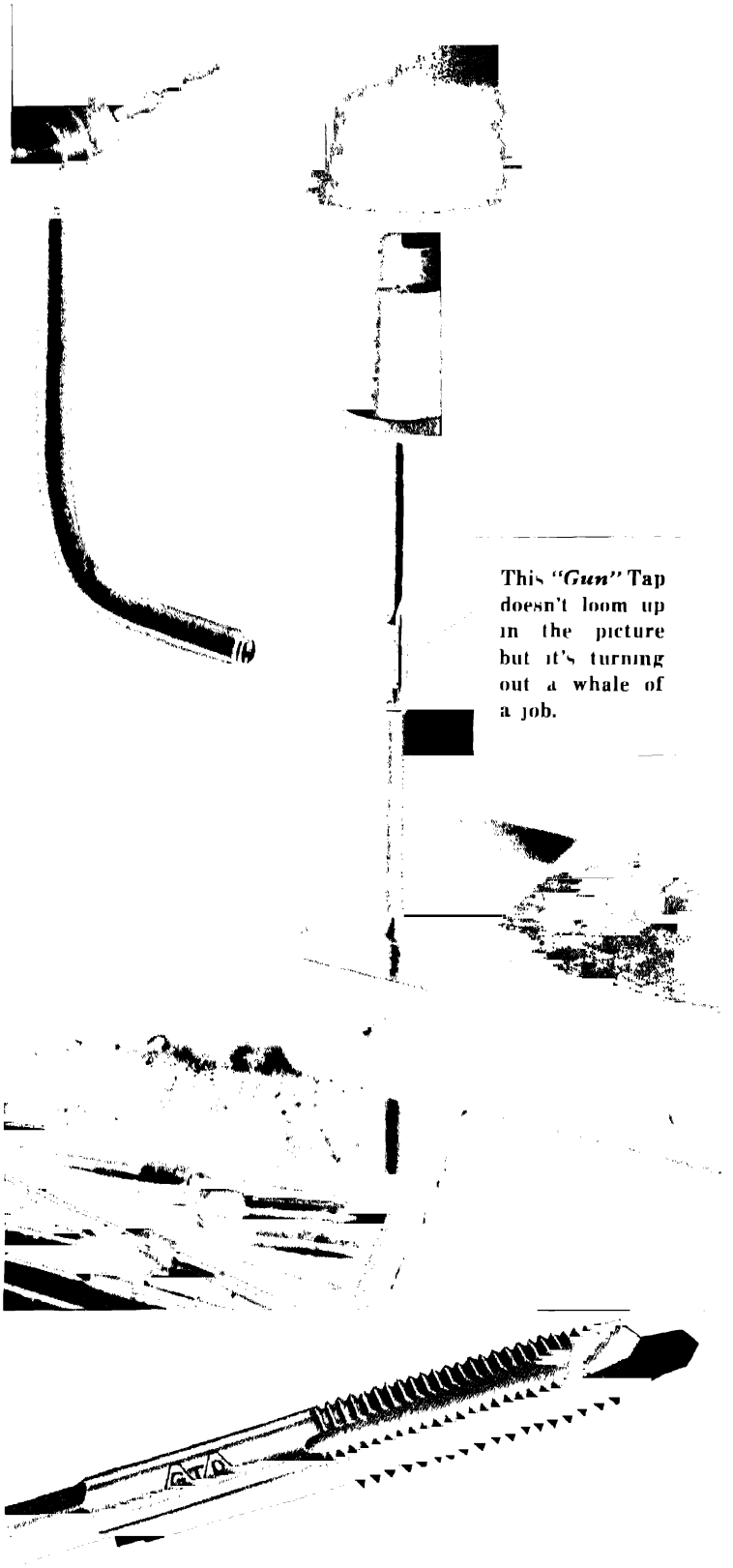
CONVERSION TABLE FOR FLAT STOCK

Width *a*

Thickness *b*

mm / in.	5 / 0.197	6 / 0.236	8 / 0.315	9 / 0.354	10 / 0.394	11 / 0.433	12 / 0.472	15 / 0.591	20 / 0.787	25 / 0.984	30 / 1.181	40 / 1.575	50 / 1.969	60 / 2.362
10	0.393	0.471	0.628	0.707	0.785	←					Kilograms per meter			
0.394	0.264	0.317	0.422	0.475	0.528	←					Pounds per foot			
12	0.471	0.565	0 754	0.848	0.942	1.04	1.13							
0.472	0.317	0.380	0.507	0.570	0.633	0.699	0.759							
14	0.550	0.659	0.879	0.990	1.100	1.21	1.32							
0.551	0.370	0.443	0.591	0.665	0.739	0.813	0.887							
15	0.589	0.707	0.942	1.06	1.18	1.30	1.41	1.77						
0.591	0.396	0.475	0.633	0.712	0.793	0.874	0.948	1.189						
16	0.628	0.754	1.01	1.13	1.26	1.38	1 51	1.88						
0.630	0.422	0.507	0.679	0.759	0.847	0.927	1.015	1.263						
18	0.707	0.848	1.13	1.27	1.41	1.56	1.70	2.12						
0.709	0.475	0.570	0.759	0.853	0.948	1.084	1.142	1.425						
20	0.785	0.942	1.26	1.41	1.57	1.73	1.88	2.36	3.14					
0.787	0.528	0.633	0.847	0.948	1.055	1.163	1 263	1.586	2.110					
22	0.864	1.04	1.38	1.56	1.73	1.90	2.07	2.59	3.46					
0.866	0.581	0.699	0.927	1.048	1.163	1.277	1 391	1.740	2.325					
25	0.981	1.18	1.57	1.77	1.96	2.16	2.36	2.94	3.93	4.91				
0.984	0.659	0.793	1.055	1.189	1.317	1 452	1.586	1.976	2.641	3.300				
28	1.10	1.32	1.76	1.98	2.20	2.42	2.64	3.30	4.40	5.50				
1.102	0.739	0.887	1.183	1.331	1.478	1.626	1.774	2.218	2.957	3.696				
30	1.18	1.41	1.88	2.12	2.36	2.59	2.83	3.53	4.71	5.89	7.07			
1.181	0.793	0.948	1.263	1.425	1.586	1.740	1.902	2.372	3.165	3.958	4 751			
32	1.26	1.51	2.01	2.26	2.51	2.76	3.01	3.77	5.02	6.28	7.54			
1.299	0.847	1.015	1.351	1.519	1.687	1.855	2.023	2.533	3.373	4.220	5.067			
35	1.37	1.65	2.20	2.47	2.75	3.02	3.30	4.12	5.50	6 87	8.24			
1.378	0.921	1.109	1.478	1.660	1.848	2.029	2.218	2.769	3.696	4.617	5.537			
38	1.49	1.79	2.39	2.68	2.98	3.28	3.58	4.47	5.97	7.46	8.95			
1.496	1.001	1.203	1.606	1.801	2.003	2.204	2.406	3.004	4.012	5.013	6.014			
40	1.57	1.88	2.51	2.83	3.14	3.46	3.77	4.71	6.28	7.85	9.42	12.6		
1.575	1.055	1.263	1.687	1.902	2.110	2.325	2.533	3.165	4.220	5.275	6.330	8.467		
45	1.77	2.12	2.83	3.18	3.53	3.88	4.24	5.39	7.07	8.83	10.6	14.1		
1.772	1.189	1.425	1.902	2.137	2.372	2.607	2.849	3.622	4.751	5.934	7.123	9.475		
50	1.96	2.36	3.14	3.53	3.93	4.32	4.71	5.89	7.85	9.81	11.8	15.7	19.6	
1.969	1.317	1.586	2.110	2.372	2.641	2.903	3.165	3.958	5.275	6.592	7.930	10.55	13.17	
55	2.16	2.59	3.45	3.89	4.32	4.75	5.18	6.48	8.64	10.8	13.0	17.3	21.6	
2.165	1.452	1.740	2.318	2.614	2.903	3.192	3.481	4.355	5.806	7.258	8.736	11.63	14.52	
60	2.36	2.83	3.77	4.24	4.71	5.18	5.65	7.07	9.42	11.8	14.1	18.9	23.6	28.3
2.362	1.586	1.902	2.533	2.849	3.165	3.481	3 797	4.751	6.330	7.930	9.475	12.70	15.86	19.02
70	2.75	3.30	4 40	4.95	5.50	6.04	6.59	8.24	11.0	13.7	16.5	22.0	27.5	33.0
2.756	1.848	2.218	2.957	3.326	3.696	4.059	4.428	5.537	7.392	9.206	11.09	14.78	18.48	22.18
80	3.14	3.77	5.02	5.65	6.28	6.91	7.54	9.42	12.6	15.7	18.9	25.1	31.4	37.7
3.150	2.110	2.533	3.373	3.797	4.220	4.644	5.067	6.330	8.467	10.55	12.70	16.87	21.10	25.33
90	3.53	4.24	5.65	6.36	7.07	7.77	8.48	10.6	14.1	17.7	21.2	28.3	35.3	42 4
3.543	2.372	2.849	3.797	4.274	4.751	5 221	5.699	7.123	9.475	11.89	14.25	19.02	23.72	28.49
100	3.93	4.71	6.28	7.07	7.85	8.64	9.42	11.8	15.7	19.6	23.6	31.4	39.3	46.8
3.937	2.641	3.165	4.220	4.751	5.275	5.806	6.330	7.930	10.55	13.17	15.86	21.10	26.41	31.45
110	4.32	5.18	6.91	7.77	8.64	9.50	10.4	13.0	17.3	21.6	25.9	34.5	43 2	51 8
4,331	2.903	3.481	4.644	5.221	5.806	6.384	6.789	8.736	11.63	14.52	17.41	23.18	29.03	34 81
120	4.71	5.65	7.54	8.48	9.42	10.4	11.3	14.1	18.9	23.6	28.3	37.7	46.8	56.5
4.724	3.165	3.797	5.067	5.699	6.330	6.989	7.594	9.475	12.70	15 86	19.02	25 33	31.45	37.97
130	5.10	6.12	8.16	9.19	10.2	11.2	12.3	15.3	20.4	25.5	30.6	40 8	51.1	61.2
5.118	3.427	4.113	5.484	6.176	6.854	8.026	8.266	10.28	13.71	17.14	20.56	27.42	34.34	41.13
140	5.50	6.59	8.79	9.89	11.0	12.1	13.2	16.5	22.0	27.5	33.0	44.0	55 0	66 0
5.512	3.696	4.428	5.907	6.646	7.392	8.131	8.870	11.09	14.78	18.48	22.18	29.57	36.96	44 35
150	5.89	7.07	9.42	10.6	11.8	13.0	14.1	17.7	23.6	29.4	35.3	47.1	58.9	70.7
5.906	3.958	4.751	6.330	7.123	7.930	8.736	9.475	11.89	15.86	19.76	23.72	31.65	39.58	47 51

MORE PRODUCTION with "GUN" TAPS



This *"Gun"* Tap doesn't loom up in the picture but it's turning out a whale of a job.

When an eastern aircraft manufacturer needed to thread these brass barrels, "*Gun*" Taps were chosen. Why? Because tests proved that "*Gun*" Taps had the combined accuracy and stamina to meet the stringent requirements of the job. Cutting a 10-32 thread through this long barrel requires quite a tap. Special long shank ground thread "*Gun*" Taps were the answer. They churn through at the rate of 550 R.P.M. and turn out two finished jobs every minute. The average production is 6,000 parts per tap—with 1,000 between grinds.

Has your plant a tough job—in brass, bronze, iron, steel, plastic or fiber? "*Greenfield*" engineers can help you lick it. Ask for suggestions.

GREENFIELD TAP & DIE CORPORATION., Greenfield, Mass

Detroit Plant 10 West Fort St. Warehouses in New York, Chicago, Los Angeles and San Francisco. In Canada: Greenfield Tap & Die Corp. of Canada, Ltd., Galt, Ont.

GREENFIELD

TAPS · DIES · GAGES · TWIST DRILLS · REAMERS · SCREW PLATES · PIPE TOOL

Tell John Public The Truth

JOHN PUBLIC is on a bender. He was recently seized with the fear that he would be caught defenseless in a world in which the strong arm is supreme. When he told the government how scared he was, the administration and Congress took him into the lounge and poured out a succession of soothing drinks -billions upon billions for planes, guns, tanks, ammunition, ships.

Pretty soon he was feeling good. He relaxed comfortably under the soothing influence of the billions, believing everything was all right. BUT, what about the morning after? What about the time a few months hence when he wakes up with a headache and a bad taste in his mouth to learn that those appropriated billions haven't yet been translated into war goods?

The answer is that he is going to howl like thunder. That is, he will kick up an awful fuss unless he is told the truth NOW. And the truth is that it will take at least a year or more before manufacture of munitions is set up and rolling on a sizable scale. There is grave doubt whether it can be done that fast.

Even if it is assumed that things go along smoothly, red tape is cut, and the mistakes of 1917-18 avoided, it still will be a year before any worthwhile results can be expected.

This obvious fact is no secret. The Army and Navy know it. Many New Dealers know it. Industrialists know it. But precious little is being done to get across that hard cold fact to the public.

Packard has accepted a Rolls Royce aircraft engine contract for which it will require ten months to tool up. Westinghouse has pointed out that it cannot prepare to make munitions in less than four months to two years. Automobile manufacturers say that few if any of their machines could be turned to producing anything other than motor cars without virtual reconstruction. They emphasize, "To switch from producing passenger automobiles to airplanes, for instance, would in general be accomplished as fast and as well by building new plants as by conversion of existing facilities."

Why not tell the public the reasons why such long delays are inevitable? Most people know less than nothing about tooling up a plant or about the complex problem involved in starting manufacture of a wholly unfamiliar product.

The National Association of Manufacturers has taken the first step. It has secured the cooperation of news reel companies in showing dramatically the exacting task of making tools, dies, fixtures, and machine tools which must precede actual production of munitions.

That, however, is only a beginning. It is a one-time shot. What needs to be done is to use all possible national, regional and local media to tell the story of the tooling process so that John Public can grasp it.

There is no time to waste. The job must be done quickly, before his glow wears off and he begins asking questions. Each one of us can do a service by telling the true story to our neighbors and townspeople, to our local newspaper editors, and to all those who contact the general public.

If the public is promptly given the facts about the situation, industry is less likely to be blamed for not doing the impossible.

Burnham Finney

GAGING BUSINESS

Machine tool builders take short cuts to speed up deliveries. British reported planning to store some machines here. Navy accelerates placing of machinery contracts. Orders are large

Machine Tools—The Army and Navy will continue indefinitely to rely upon the voluntary cooperation of the machine tool industry to get what it wants rather than institute a mandatory priority system. That fact was established at meetings in Washington the past week. Various short cuts are being taken by builders to speed up deliveries of machines vital to defense requirements, especially large planers and boring mills. Orders for big machines roughly estimated at five million dollars will be allotted this week by one branch of the government. The Navy hopes to put machine tool contracts running into millions into the hands of the industry within ninety days, whereas normally the time for placing such business extends over nine to ten months. Having taken over all French orders, the British are reported planning to store some U. S. machine tools upon completion until they know exactly what they want to do with them. Shipments are contemplated to Canada and Australia as well as to England, while many machines probably will be installed in U. S. factories with British contracts. The export licensing system recently put in force has caused much confusion and delay in shipments from Builders' plants. Machine tool bookings continue at recent high levels, with inquiries excellent. A shortage of certain types of skilled machinists in metal-working plants is becoming more acute.

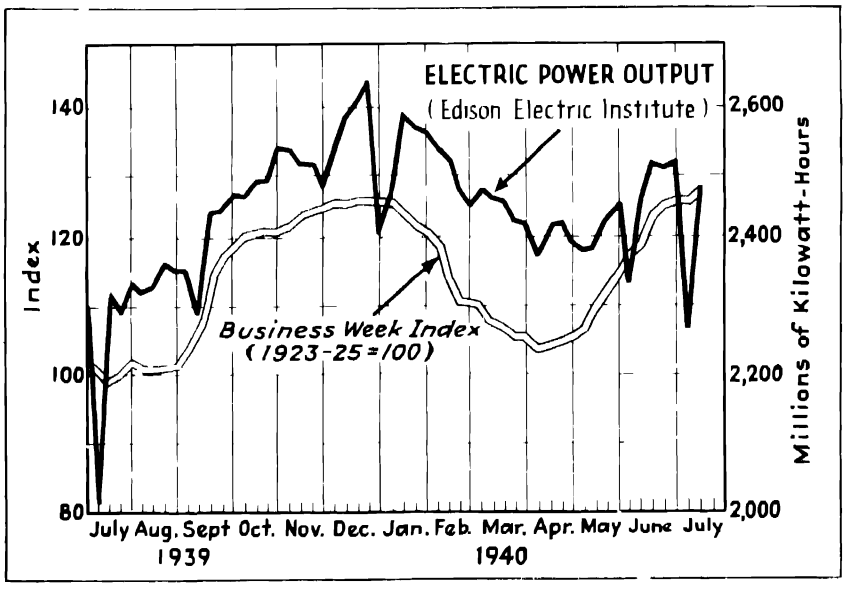
Munitions. Placing of orders by the Army and Navy is well under way. The Army Ordnance Division has available for its program $653,688,517, and the Ordnance Department of the Navy $164,591,478. New appropriations proposed by the President but yet to be enacted by Congress will give further cash and contractual authority amounting to $1,502,155,545 to the two Ordnance Departments, all but $60,293,000 being earmarked for the Army. The government's new powder making plant apparently is to be located close to Louisville, Ky. American Car & Foundry has secured an army order for 627 more light tanks to cost around $11,000,000. The company now is producing almost 1,000 tanks for the U. S. Government. Volume production of the Garand rifle soon will be speeded up when the Winchester Company gets into full swing, supplementing the output at the Springfield Armory. Two orders totaling over $7,000,000 have been awarded for gun carriages. Armor plate manufacture is being expanded to meet the government's increased needs, particularly for battleships and tanks.

Farm Equipment. The industry is going into its usual slack season. Tractor manufacture however continues active, with some makers just now beginning to cut down their backlogs of orders. Haying and harvesting equipment sales are still good, with industry showing great interest in new machinery for handling green silage. International Harvester has been experimenting with one model, and Allis-Chalmers has announced new equipment for this phase of farm mechanization. Harvester expects to complete expansion of its East Moline works for production of its new small combine by early fall. It has purchased new machinery for its works at Chicago designed to increase production of small tractors 60 per cent.

Railroad Equipment—Freight cars ordered during the first half of 1940 totaled about 10,585 units, compared with 9,000 for the same period a year ago. One hundred eighty-seven locomotives were booked, against 152 last year. Illinois Central has placed a contract for 1,000 steel box cars with the Bessemer, Ala., plant of Pullman-Standard Manufacturing Company. Union Pacific is inquiring for 1,000 ballast cars, and Atlantic Coast Line for 1,665 freight cars. The Reading is expected to buy 10 diesel electric switchers.

Steel. Though steel ingot operations are not far from 90 per cent, the full force of the defense program will not be felt for some months. Production is likely to stay close to the current level in the immediate future. Some increase is being made in electric furnace melting capacity since alloy steels will play a vital role in defense efforts.

Aircraft. Standardization of plane types, now agreed upon by the Army and Navy should help to accelerate production. Eager to expand their output plane makers are scouring the country for machinists and machine operators bidding against older industries for their services. One important engine maker is known to be considering a new factory in the middle west to employ 10,000 men supplementing its present facilities. Ford is authoritatively reported to have abandoned all plans for entering any phase of mass production of airplanes or plane parts. Newest entry into the field of aircraft parts is Briggs Manufacturing Company, well known automobile body builder.



2 Billions for Airplanes, 1½ for Ordnance, Are Big Features in New Defense Request

If granted, new-sought-for appropriation of $5,000,000,000 would double year's defense budget, provide 19,000 more planes

WASHINGTON -The President has asked Congress to buy the country two billion dollars worth of airplanes and a billion and a half dollars worth of ordnance This request was the big feature of a five-billion-dollar appropriation asked by Mr Roosevelt which will double this year's defense budget to provide equipment for an army of 1 200 000 men and the most-hard-to-get stuff for 800 000 more

The airplane money $2 023 402 000 will purchase 19 000 additional planes 15 000 for the Army and 4 000 for the Navy Of $106 246 000 for the Signal Corps the larger part is for radio equipment to go in the airplanes An ordnance figure of $1 552 456 000 includes substantial sums for the armament of the new airplanes but will mostly cover tanks munitions and artillery The engineer service will have an extra $42 296 200 to spend on searchlights portable bridges trenching machine and the like

For expansion of plants to produce military equipment $325 000 000 is sought to be spent at the discretion of the Secretary of War This brings to more than a half-billion dollars the amount available for this purpose plus an indeterminate part of the President's $200 000 000 blank check

A start is made on the huge expansion of the Navy just authorized by Congress with an appropriation of $178 000 000 Most of this sum will be used for construction of shipways armor plants and other production facilities since the country's shipbuilding capacity is already full

The shore construction program of the Navy for the next fiscal year runs to more than $200 000 000 The Navy will have authority in the program to negotiate contracts on cost-plus-fixed-fee basis the fee not to exceed six per cent It is not definite that all contracts under this program will be let on a negotiated basis even though legislation empowers the Navy to do so if conditions should warrant Where time permits, certain bids will be taken as usual

Programs for defense to date include both the A and B plans of the government for mobilization of industry The A program is the initial production needed for a million men The B program if carried out complete, would involve equipment for an army of four million men Thus the appropriations now before Congress call for rounding out the A program and taking on a slice of the B program Some observers erroneously refer to the current five-billion-dollar request of the President as the B program

No Priorities for Machine Tools To be Established at This Time

WASHINGTON — No legal priorities for machine tools will be established by the Federal government at this time The decision was made at meetings held in this city during the past week and participated in by the army navy and representatives of the industry

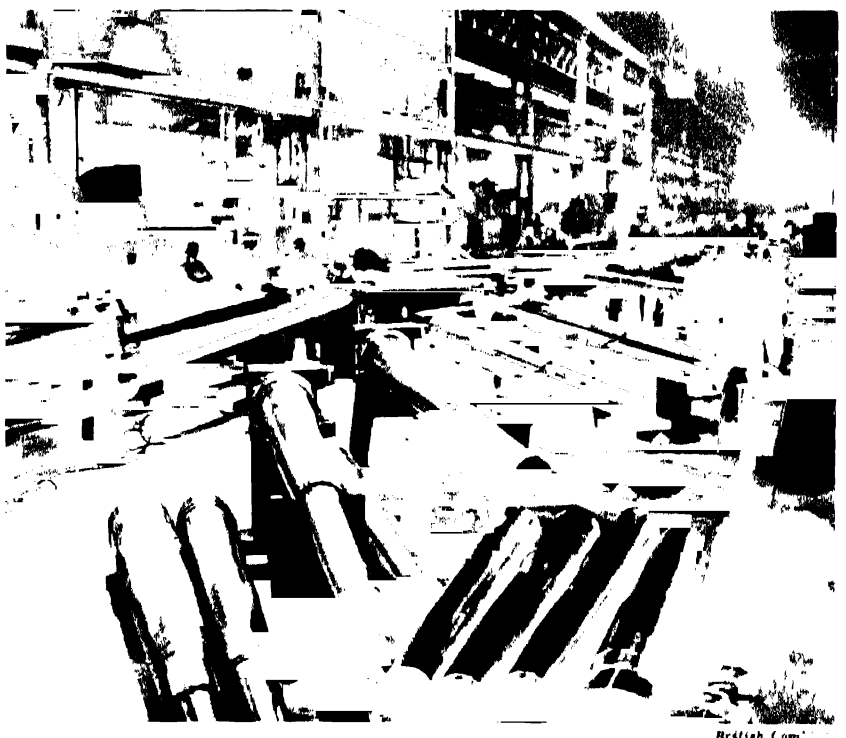
The government will continue to rely upon the voluntary cooperation of the industry to see that its armed forces and private industry with munitions contracts secure machine tools when they need them The industry itself put cooperative action into effect early in June when it proposed formation of the Machine Tool Coordinating Committee composed of representatives from the industry and from government

Export License Exemptions Allowed by State Department

WASHINGTON -The Division of Controls of the Department of State has advised collectors of customs throughout the country that no licenses will be required for export of the following articles 1 Portable tools driven by fractional horsepower motors or by compressed air, 2 Brakes rolls shears and small punches if hand-operated, 3 Repair parts for machine tools other than important sub-assemblies in quantities not sufficient to constitute a substantially complete metal-working machine of the character mentioned in the President's proclamation of July 2 in unassembled form, and 4 Small tools such as cutters drills, taps and grinding wheels

Much confusion has arisen regarding the way in which the export licenses are granted Application must be made direct to the Department of State but approval is given by the Administrator of Export Control in consultation with the Army and Navy Munitions Board It is not necessary to secure a separate license for each machine exported only for each shipment made within a specified time such as a week to the same destination

It is reported several thousand letters of inquiry pertaining to export licenses have piled up at the Department of State Extra shifts have been employed to take care of this extraordinary volume of correspondence



British Com.....

"Roll out the Barrel" — *In industrial Britain continues the production speed up of anti aircraft guns an ordnance factory in England houses a group of 37 .1A guns to be fitted with breachblocks*

Government Plans to Finance Expansion; Three Separate Methods Being Considered

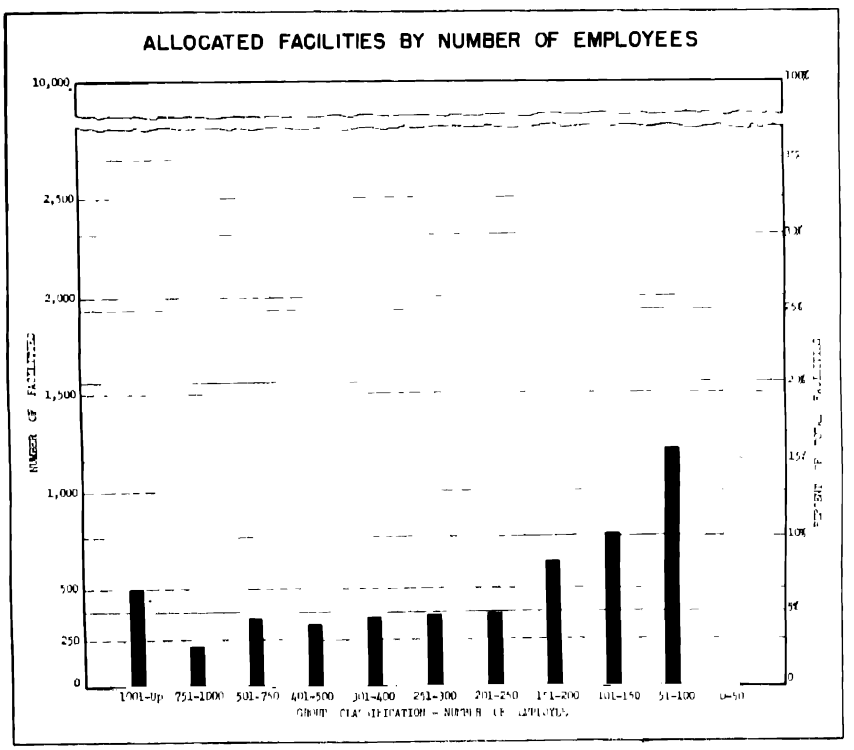
WASHINGTON—Now that the general dimensions of the armament program are becoming clear and that appropriations are beginning to be translated into orders, thoughts are turning to the methods by which the immense expansion of plant that will be needed can be achieved. It is generally assumed that private finance cannot provide the money. Bankers and investors don't want to put their money into facilities that might be made useless by a disarmament conference; manufacturers don't want to assume big debts, or increase their capitalization. Government is getting ready to do the job

Three quite distinct methods are being developed. So far there is almost no coordination between them and only a rather vague differentiation of function. RFC has received authority to make loans for expansion of defense plants. The Army and Navy have been authorized to make advances up to 30 per cent of the face value of defense contracts. And there is more than a half billion dollars of federal money available for outright government financing.

In general it appears that RFC loans will finance most plant expansion. The advances will mostly be used for working capital. The government will pay for facilities having no commercial utility at all—such things as plants to make smokeless powder and special railroad cars to carry tanks. These last will be owned by the government and operated by private industry, probably under a leasing arrangement.

RFC loans bear 4 per cent interest and are amortizable over three to seven years. Loan Administrator Jesse Jones told AMERICAN MACHINIST that the amortization term will conform to the amortization rates Congress sets up when it acts on the tax bill. The President has suggested a term of five years. Although RFC officials refuse to commit themselves, it appears that the sole security for the loans will be a mortgage on the facilities built with the proceeds of the loan; the borrower will not have to pledge his general credit. This means that if the armament boom blows up, RFC rather than the manufacturer is stuck with the excess plant. Some manufacturers will probably make this doubly sure by setting up subsidiary corporations to borrow money and build plant which will then be rented to the parent corporation.

Except that salaries paid by borrowers must be "reasonable" there are not supposed to be any management strings on RFC loans. Whether recommendations as to location and the like will be attached to defense commission certifications remains to be seen.



Little Fellows *are to get their share of government orders, as this chart shows. Much of the work has gone to shops having less than 50 men*

NEW DEFENSE CONTRACTS

WASHINGTON — Among recent outstanding defense contracts awarded by the War and Navy departments are the following: Spartan Aircraft Co., Tulsa, Okla., $1,859,880 for airplanes; National Supply Co., Holmesburgh, Pa., $219,100 for engines; Baldwin Locomotive Works, Philadelphia, Pa., $268,010 for hydraulic press; and Mine Safety Appliances Co., Pittsburgh, Pa., $207,722 for submarine escape apparatus.

Shortage of Labor May Hinder Packard in Making Plane Engines

DETROIT—Packard was still negotiating with the government last week for a contract to build 9,000 Rolls-Royce engines, president M M Gilman being empowered by the board of directors to reach an agreement Incidentally, letters from stockholders and outsiders apparently uphold Mr. Ford's position in respect to building engines for the British But Packard is interested in getting a contract that will not leave it holding the bag if the war should be over soon

Doubtless Packard will eventually sign a contract when satisfactory terms are concluded. Not the least of its troubles then will be to secure the 14,000 men envisaged for peak Rolls-Royce production It is likely that Packard has 15,000 employees available, of which 10,000 are needed in current automobile manufacturing and 5,000 are on the secondary list

It is said that at least six weeks will be required for the Packard organization to redraw the British prints to American standards. Outside engineering skill regards this estimate as conservative. One of the greatest jobs, if not the greatest, is to determine the type of fixtures most adaptable to a given problem, in order to maintain aviation standards of accuracy and to be suitable for interchangeable use on machine tools. In some cases, several fixtures will probably be used on the same machine for operations like tapping and drilling somewhat similar pieces Obviously full consideration of the numerous factors involved in securing maximum utility, productivity and accuracy of fixture and machine set-ups requires a high degree of tool engineering experience. Likewise time. It may be months before Packard is able to show concrete results from the planning stage.

Ford is reported going ahead quietly upon development of a simplified engine after his experience in drawing up production plans for the Rolls Royce. It is said that possibly two of these engines will soon be finished in the toolroom.

Canada Speeds Ship Construction, Pushes Expansion of Facilities

MONTREAL—When the Canadian government last January appropriated $50,000,000 for a wartime shipbuilding program it scheduled 64 submarine chasers and 26 minesweepers to be completed within two years Originally deliveries were to start in November Actually, due to a speed-up ordered last spring, deliveries have already begun During the last week of June at Montreal Canadian Vickers launched the first of the new boats Three more were launched the following week The schedule now calls for deliveries every week from various shipyards Today government announcements speak of an 82-ship program this year rather than the 100 planned in the two-year project

At an estimated cost of a little more than $500,000 each submarine chasers are being built by the following Kingston, Ont., and Collingwood, Ont shipyards, 46 Davie Shipbuilding Co, Lauzon 10; Canadian Vickers, Montreal 8, Marine Industries, Sorel, 7, and Morton Engineering Co, Quebec, 6 Minesweepers which are to cost about $620 000 each are being built in shipyards inactive heretofore, in British Columbia and at the Great Lakes

At the beginning of the war Britain advanced $50 000,000 for plant expansion in Canada To supplement this, large appropriations for production facilities have also been advanced by the Canadian government (Because such investments will have a dubious value after the war private capital is not interested) At a cost of several million dollars Canada will build a huge plant for the production of war chemicals at Beauharnois near Montreal, and although the government will own the plant, it will be operated by the Canada Wire & Cable Co The government will take all production at a cost basis

Although the speed-up in war material production is well under way 24-hour schedules are still the exception To counteract the shortage of trained men in the machine tool industry, federal money is being used by provincial governments to train thousands of young men this summer in special courses for aircraft production and other skilled trades However some observers indicate that Canadian industry shall be able to pull en masse in the war effort by this fall

To further aid a united war effort strikes and lockouts have been outlawed by the Canadian government for the duration of hostilities A regulation which applies to all companies requires each labor dispute to be submitted to a federal conciliation board on which labor and the employer is represented



Down Beat *Metallurgical improvements frequently bring interesting results to unusual industries To secure a more rapid production of spun shapes for brass horns trombones etc engineers recommended the use of spinning forms closely cast to shape in Meehanite metal*

MURRAY ENTERS AIRCRAFT FIELD

DETROIT Murray Corporation of America has formed an aircraft division under direction of Richard C Gersch One wing of the Russell Street plant will be used for aircraft assembly work The Briggs Manufacturing Company will produce at its Detroit plant complete metal wing assemblies for scout planes for Vought-Sikorsky Division of United Aircraft Corporation

TUNGSTEN SHORTAGE POSSIBLE

TOKYO To date the Japanese have conquered one-third of China which produces most of the world's supply of tungsten Despite the fact that China's principal mines are still out of Japan's reach it is highly possible that the mines may soon fall into Nippon's hands

Tungsten exports have been one of the most important factors in the financing of China's imports of war materials from the U S and elsewhere

U. S. Government Contracts Awarded to Tool Makers

Defense Contracts on Page 548

Contractor	Govt Agency	Commodity	Amount
The Buda Co Harvey Ill	Norfolk Navy Yd	Parts for die chucks	$98 872
Foote Bros Gear & Machine Corp Chicago Ill	TVA	Valve machinery	27 000
Caterpillar Tractor Co Peoria Ill	QMC	Tractors	77 860
Jones & Lamson Machine Co Springfield Vt	Ordnance	Turning lathe	21 106
The Toledo Machine & Tool Div of J W Bliss Co Toledo Ohio	Ordnance	Cupping press	23 796
Gisholt Machine Co Madison Wis	Navy	Lathes turret	22 311
Brown & Sharpe Mfg Co Providence R I	Navy	Machines milling	18 196
Jones & Lamson Machine Co Springfield Vt	Ordnance	Lathes	61 197
American Hoist & Derrick Co St Paul Minn	Navy	Winche	26 968
International Engineering Inc Dayton Ohio	Air Corps	Steel assembly engine overhaul	20 023
Smith Courtney Co Richmond Va	Engineer Corp	Boring mill	23 018
Smalley General Co Pine City Mich	Ordnance	Milling machines	23 588
Kearney & Trecker Corp Milwaukee Wis	Ordnance	Milling machines	27 284
Allis Chalmers Mfg Co Milwaukee Wis	Panama Canal	Pumping units	172 589
The National Acme Co Cleveland Ohio	Ordnance	Automatic machines	35 996
Caterpillar Tractor Co Peoria Ill	Navy Marine Corps	Tractors	62 640
The C H Cosgrove Machinery Co Dayton Ohio	Air Corps	Drill presses	21 730
International Harvester Co Inc Washington D C	Procurement	Tractor	10 24
Cincinnati Milling Machine & Cincinnati Grinders Inc Cincinnati Ohio	Ordnance	Milling machines	62 618
The Toledo Machine & Tool Div of J W Bliss Co Toledo Ohio	Ordnance	Presses	51 651
Cincinnati Milling Machine & Cincinnati Grinders Inc Cincinnati Ohio	Ordnance	Milling machines	3 33
International Harvester Co Chicago Ill	Ordnance	Tractors	32 857

Federal Training Agencies Coordinated To Increase Skilled Labor for Defense

WASHINGTON—Given an adequate supply of materials, human skill is the other main ingredient of the defense program The National Defense Commission has set up a "labor problems and labor training" division, headed by Sidney Hillman, which has taken over the problem of expanding the supply of skill This is being done by coordinating the efforts of four government agencies which were already engaged in training programs These four agencies are the Education Office of the Federal Security Agency; the National Youth Administration, the Civilian Conservation Corps, and the Federal Committee on Apprenticeship of the Department of Labor

If necessary, facilities can be made available to train 1,500,000 people, creating employment opportunities for qualified unemployed, and voluntary retraining for present workers As shortages develop in certain skills, the Hillman office will concentrate on opening the bottleneck

Who Can Do What?

First problem is to determine skills of employables Classification of 5-500 000 registered workers is being made by the Employment Service of the Security Agency Feasibility of testing skills is being considered If they are tested they will be rated accordingly for the employment reserve Quick development of high skills can best be accomplished in industry itself through an in-service training program under which workers would be moved up through on-job training and vocational courses, says Mr Hillman Plants now train relatively few employees he states

Recent appointment by Mr Hillman of a Labor Policy Advisory Committee, consisting of representatives of AFL, CIO and the Railway Labor Executives Association, gives organized labor the voice it demands in defense policy Labor leaders have agreed to cooperate, if they are permitted to maintain their labor standards and put their unemployed members to work The labor unions, especially the machinists, opposed government training of more men because they said thousands of their trained members were still unemployed The Committee therefore recommended that an inventory of experience and skills be undertaken at once, the result to be available to private industry, and that in so far as possible, the allocation of orders for defense materials be distributed to make full use of unemployed workers

Training Agencies Cooperate

The job of coordinating training agencies has been assigned to Floyd W Reeves, Mr Hillman's executive assistant for labor supply Mr Reeves is director of the American Youth Committee, a non-governmental organization, and also is a professor of administration at Chicago University Owen D Young is chairman of the Youth Committee, an agency for the welfare of young people

Most important of the skill-building organizations at the outset is a combination of WPA and the Office of Education With $9 781 340 allotted to WPA and $15,000,000 voted to the Education Office by Congress, enrollment of 150,000 men has been started for short-term training in 600 of the nation's vocational schools Fifty thousand of the men will be taken from WPA rolls, and the balance selected by State and federal employment services Classes are being held in July August and September

U. S. Government Contracts Awarded to Metal-Working Firms

(Other Metal Working Contracts on Page

Contractor	Gov't Agency		
Babcock Printing Press Corp New London Conn	Ordnance	Machine shop	$183 131
National Lube Co, Washington D C	Navy	Steel racks	67 890
Boston Wire Stitcher Co, East Greenwich R I	Engineer C	Wire staples	38 240
American Forge Division of The American Brake	Ordnance	Forgings for shell	70 240
Lundquist Tool & Mfg Co Worcester Mass	Ordnance	Telescope mounts	105 710
Fort Pitt Bedding Co, Pittsburgh Pa	Ordnance	Metallic belt links	119 200
York Safe & Lock Co York Pa	Ordnance	Gun carriages	829 00
Saginaw Steering Division General Motors Corp Detroit Mich	Ordnance	Machine guns	726 004
Norris Stamping and Manufacturing Co Los Angeles Calif	Navy	Cartridge containers	333 728
Midvale Co, Washington D C	Navy	Steel forgings	245 537
Midvale Co, Philadelphia Pa			
Bethlehem Steel Co Bethlehem Pa	Navy	Steel forgings	210 000
Vega Airplane Co Burbank Calif	Air Corps	Frames assemblies	63 550
Carpenter Steel Co, Reading Pa	Ordnance	Steel rods	61 528
Crucible Steel Co of America New York N Y	Ordnance	Steel rods	82 002
Pennsylvania Forge Corp Philadelphia Pa	Ordnance	Steel forgings	107 016

MORE MACHINERY FOR LYCOMING

DETROIT — Aviation Manufacturing Corporation will spend $1,400,000 for machinery and equipment for its Lycoming Division which manufactures aircraft engines An additional $300,000 is to be expended for machinery for production of hubs and propellors The company has large U S orders.

Hillman May Appoint Understudy As CIO-AFL Disputes Continue

DETROIT—Continuing jurisdictional disputes between the UAW-CIO and the AFL crafts unions may force Sidney Hillman, government Employment Policies Coordinator, to appoint a regional understudy for this area, and for other industrial centers An official with governmental authority is needed here to standardize relationships between the two unions and to prevent production blocks arising out of such disputes Observers indicate it is unnecessary and time wasting to ask Washington for a ruling on every detail, which although minor compared to national labor problems is important to the local auto industry during the changeover season when every day lost is extremely costly

The need for such a step was forcibly brought again to the fore on July 3 when a jurisdictional fight developed in a local body plant over which union should handle the job of moving heavy presses Probably out of fear that granting permission for AFL craftsmen to do the job might prove a foothold to the rival union, the CIO local refused AFL participation Actually the CIO does not possess millwrights machine foundation men, and specialized welders Skilled men in these categories belong to AFL craft unions and are only needed temporarily AFL teamsters countered the CIO by threatening to discontinue shipments into and out of the plant Thus a plant employing thousands of men could have been tied up because of inter-union friction over a minor matter With UAW-CIO national officers inclined to temporize because of the power of local unions, the situation needs clarification by men of the stamp and authority of Hillman

Doubtless Hillman will issue instructions from Washington to impose more discretion on the future actions of the UAW-CIO and the local AFL group, especially where model change-over programs will be jeopardized To prevent similar occurrences in the future, particularly when armament orders are placed, it may be well to have a local labor administrator who has the power and vision to standardize inter-union relationships and to prevent production blocks

INSIDE DETROIT

Car shortage threatens as public unleashes buying power in fear of rising prices. Boosts are inevitable because labor and materials have risen several per cent in year

BY RUPERT LE GRAND, DETROIT EDITOR

DETROIT—Automobile manufacturers consistently lowered prices and increased values during 1938, 1939 and 1940 through direct reductions in list prices and by throwing in accessory items previously considered extras. But recent increases in material and labor costs plus higher taxes will undoubtedly reverse the recent trend. There is reason to believe that 1941 models may carry price tags asking at least $25–$30 more for lower-priced models, with proportionately greater increases applied to higher-priced lines.

Packard and Hudson raised prices of current models following imposition of the new federal excise tax of one-half of one per cent. In the latter case, the boosts of $14–$40 apparently seeks some compensation for higher manufacturing costs as well as prepayment of the new federal levy.

Several important elements of cost have advanced during the past twelve months. The rise in cost of raw materials is aptly illustrated by the average cost for 3,550 lb. of a score or more basic materials required to fabricate a low-priced sedan. In 1939 the average cost of these materials was approximately $135. But in 1940 the average cost has risen to $140. This $5 gain is conservative for figuring future commitments because of the wide fluctuations that occur monthly in various materials. For example, the low point for these materials was $135 in April, the high point was $143 in June, and the July figure fell to the average of $140, principally because of sharp declines in rubber, copper and wool prices. Yet all three materials might advance sharply.

Labor costs have advanced. A year ago the average wage paid in the automobile and parts manufacturing industries was approximately 90 cents. Today it is 94 cents. It has been suggested from a reliable source that the number of hours actually expended per car is approximately 250, neglecting the rubber, glass and textile industries. Therefore, it is apparent that labor costs have advanced at least $10 per car.

The Federal Trade Commission reported that the average profit per car was approximately $29. Obviously increases in wages and material costs have eaten seriously into the profit expectations of lower-volume producers, despite the upturn in sales during the past year. Competitive positions, as well as cost sheets, have a hand in setting car prices, but any general increase in prices will be a boon to the independents. Doubtless, manufacturers know the approximate new prices, but a final decision is not usually made until within a few days before announcement time.

Sales Gains Continue

Sales of new and used passenger cars to domestic consumers took a contra-seasonal upward turn in June, which bids fair to continue through July. Early returns for the first ten days of this month show that new records are being established for the summer season. For example, Pontiac had the best first ten days in July for any similar period back to 1928. It sold 6,643 units as compared with 3,341 a year ago, or practically a 100 per cent gain. Chevrolet disposed of 27,869 new cars and trucks, exceeding the first ten days of June, and surpassing the first ten days of July, 1939, by 50.6 per cent. This is considered a remarkable showing in view of 102,615 new car and truck sales in June.

Reports like these are mighty cheering to sales executives. Definite figures of new-car shortages are withheld, but there are indications that some factories could have built a few thousand extra units. Field stocks in the hands of dealers serving closed factories are such that only a month's supply remains. Thus, some dealers and certain sections may lack cars before public appearance of new lines, and must devote their attention to remaining used car stocks. It is probable that showrooms will actually be opened to the public in advance of scheduled announcements.

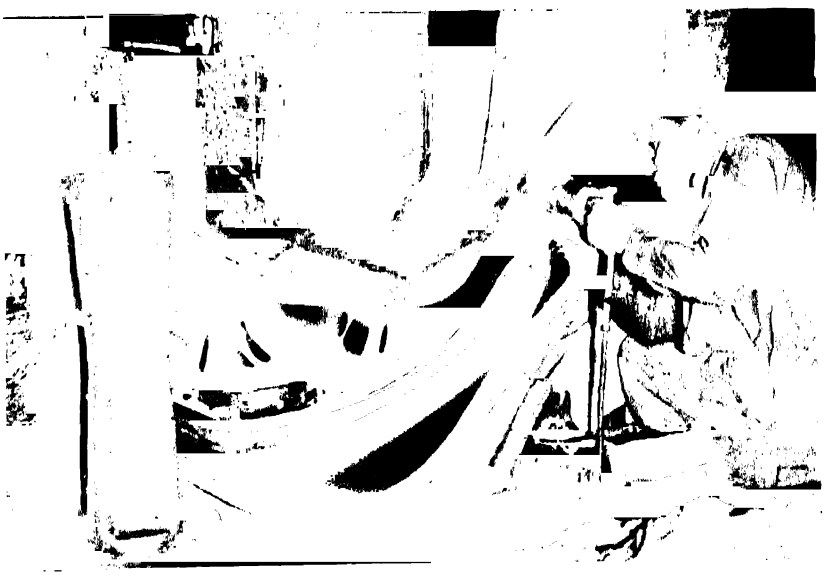
Used-car sales are doing well. Pontiac sold 13,174 units in the first ten days of July and had only 40,238 in dealer stocks. Chevrolet disposals reached 44,227 units, to attain the second highest total for the period in this division's history. Used-car inventories are normal or less than normal.

Chevrolet Gains

Production of the 1,000,000th current-model Chevrolet on July 12 discloses that this maker's output is 25

HUGE MUNITIONS CAPACITY

DETROIT—Fear that automobile makers may get so involved in munitions manufacture that they won't be able to meet the demand for motor cars is ill-founded. The truth is that the industry has enough plant capacity to turn out 5,000,000 cars a year and still produce large quantities of ordnance material. And the trick of getting the manpower isn't too hard.



Safety Blocks—*Because safety blocks made of Downmetal, industry's lightest structural metal, provide an additional safety precaution in die openings of sheet metal forming processes with men at work, they have been meeting with increased favor among machine operators*



Bearings from Strip—*After fusing metal powders to a steel backing strip and flowing high-lead babbitt into the sintered matrix, Moraine Products mills the strip thickness and stamps out blanks for new-type Buick engine bearings. Life of the bearing is claimed to be doubled*

per cent ahead of what it was on the same date a year ago. The figure then was 798,343.

It is likely that Chevrolet will produce in excess of 100,000 additional units before the anticipated model changeover during the middle of August.

Several years have passed since any maker has topped 1,000,000 units, which makes the relative sales position of Chevrolet, Ford and Plymouth of interest. Estimates are for through May.

"Big Three" Sales Positions

(Per Cent of Price Class Market)

	1940	1939
Chevrolet	43.5	41.0
Ford	28.1	31.0
Plymouth	22.4	25.0
Others	6.0	1.0

It is obvious that the gains made by independents have been at the expense of Ford and Plymouth. In the automobile industry, it is generally considered that an up or down swing of one or two per cent in the low-priced volume market is the result of a fierce competitive struggle.

Educational Order for Saginaw

Production of 500 machine guns at the Saginaw Steering Gear Division of General Motors can hardly get under way before October. Equipment valued at approximately one-fourth of the contract price had to be purchased. Orders went out about the first part of July. It is reported that the government desires to obtain 250,000 machine guns eventually. Very likely, Saginaw's success with this educational order, and its experience in small-parts manufacture generally, will prove a factor when quantity contracts are let.

The fact that Saginaw allotted one-fourth of the contract price to new machinery and tooling is unusual with educational orders. In many instances, the smallness of the contract has prevented setting up the type of tooling actually needed for large-scale manufacture and buying up-to-date machinery. In too many cases, contractors have been forced to do with idle equipment or to divert equipment to the government contract for a short period. Tooling, which is the essence of the scheme, has not ordinarily been developed to a high point of efficiency or productivity.

New Bearing for Buick

Buick's 1941 models will be equipped with a new-type high-lead babbitt precision bearing, said to show an increase in engine bearing life of over 200 per cent. Developed cooperatively with Moraine Products Division of General Motors, "Durex 100" main bearings involve application of powder metallurgy. A matrix of pure copper and nickel powders is deposited upon straightened strip-steel backing material. The coated strip enters a four-stage electric furnace where the matrix is permanently bonded to the steel by sintering. The strips are then recoiled.

During intermediate processing, the matrix-coated strip is again straightened and welded automatically for continuous feeding through a tunnel-type vacuum machine wherein babbitt is flowed over the matrix in three stages. The vacuum exhausts air from pores in the matrix, permitting the babbitt to fill the sponge-like structure completely. In the fourth stage, the thickness of the babbitt is held to a close limit.

In a third processing line, the babbitt is milled to thickness by down-cutting and climb-cutting, leaving 0.005-0.010 in. for final finishing. The milled strip passes directly to a press for shearing retangular blanks to form bearing half-shells. Blanks are transferred to a machine shop for forming, sizing and finishing prior to shipment to Buick.

Buick's new bearing is made to withstand operation with high compression ratios, permitting the new models to take advantage of economy and performance expected from the new high-octane fuels to be available this fall. The thin layer of babbitt used in Durex 100 bearings will prevent, it is said, the formation of incipient fatigue cracks, and was made possible by development of the new method of bonding a hard matrix to a steel backing shell. It is reported that the new bearing completely meets the requirements laid down five years ago for the "ideal" bearing by A. F. Underwood, head of the mechanical engineering department, General Motors Research Laboratories, and now achieved for the first time.

FORD SIX FOR '41

DETROIT—All signs point to a new Ford six about the first of the year. The OMA model, scrapped months ago, has given way to the 1G, which is designed apparently along conventional lines. At least the overhead camshaft on the OMA has been given up. To go with the new engine, Ford will probably have a body built along somewhat radical lines, especially in matters of weight saving and frame construction. The butt-welded frame may utilize rather unusual cross-sections, made possible by exceptionally accurate control of press-shop operations.

Large Airplane Factory Shift Made by Hall Aircraft Corp.

The first sizable shift of an aircraft factory away from the coast is scheduled soon, for the Hall-Aluminum Aircraft Corp. will close its Bristol, Pa., plant and establish a $5,000,000 airplane factory at Dallas, Texas, to build bombers and pursuit ships for the U. S. Army.

Dallas Chamber of Commerce officials indicate that executives, technical directors, and minor employees will be transferred from the east. The new plant will employ 5,000 men and have a monthly payroll between $750,000 and $1,000,000, and will be the largest industrial establishment in Texas.

WATCHING WASHINGTON

Machinery for national defense swings into action as increasing amount of red tape is cut. Question of profits holds spotlight. Amortization of new plant capacity remains a major problem

BY BLAINE STUBBLEFIELD

WASHINGTON—The national defense machine still is chugging along in low gear It won't be long however until it will shift into second if not into high Red tape is being cut to speed things up But obviously contracts cannot be placed until the money is available and the biggest Army appropriation of all totaling around four billion dollars is yet to go through Congress And Congress has served notice that it doesn't intend to be rushed off its feet again by pressure to jam through defense money overnight without adequate hearings

One of the factors tending to hold the defense machine back is the lack of legislation to clarify amortization rates on new plant capacity constructed solely for defense purposes The White House has indicated that five years is an acceptable amortization period with half the debt to be written off the first two years But the bill making such action legal hasn't yet been introduced in Congress let alone passed The Treasury adamant against any concessions to industry hasn't changed its mind but has been forced into line by Mr Roosevelt according to reliable reports

It would be a mistake to get the idea that speed isn't being shown As an example one government department with equipment orders running well into the millions and including hundreds of items for the fiscal year 1941 expects to have all the work under contract by October 1 or shortly thereafter That is in sharp contrast with the 1940 performance when awards were still being made almost up to the end of the fiscal year

And don't worry too much about government operation of plants which would have other than a wartime use True the TVA crowd is itching to make their organization a spearhead for government ownership and management of industries connected with defense activities But Army and Navy officials are opposed to such shenanigans saying that government operation will go through only over their dead bodies Army people are well aware of the fact that short hours long vacations sick leave and the general lowered efficiency which seems to go with government operation would slow down the defense program if the government insisted upon running manufacture instead of private industry's doing the job

Governmental arsenals and Navy yards now have tough time enough trying to compete for labor against private industry An arsenal for instance is permitted to pay the going wage in its local community In order to change the rate the commanding officer must secure authority from Washington proving that the rate has risen By the time he approval is secured the rate paid by private industry has gone still higher The government doesn't move fast enough to keep up with private industry That puts the arsenal officers constantly behind the labor eight ball

Paper Plane Program

A 25 000-plane aircraft program has been completed on paper the defense commission says George Mead Knudsen's aircraft specialist has worked out with Army Navy and the British a plan to standardize on existing types What types have been standardized on is supposed to be a military secret but it's understood that the plan means essentially that we will continue to build the planes we are building now turning them out in quantity without changing the specifications every third unit

FEWER DRAFT EXEMPTIONS

WASHINGTON The proposed Selective-Service Act being debated by Congress calls for a much stricter interpretation than the plan used in the World War Fewer lines will be classified as essential industries this time For example a man will not be exempted because he is a riveter in a shipyard He will be enrolled and assigned to the job if it is proved that he is essential Ordinary physical disabilities such as poor eyesight underweight flat feet and minor handicaps will not exempt men They will be listed and assigned to their present or other duties as best fits the case Non-essential industries will be given time to replace employees selected by local boards for service The period allowed will vary

A start has been made on the next step of allocating production among manufacturers On the 4 700 combat ships and 3 900 trainers already appropriated for contracts are about ready to award as soon as Congress straightens out the amortization tangle and negotiations are already under way on the 19 000 additional ships the President has asked Congress to buy

Fight Over Profits

On no aspect of the defense program has there been more confusion and vacillation than on profit restrictions and the companion problem of amortization of expanded plant At present the question is wide open until Congress re-examines it and contractors and contracting officers are all at sea

For the past several years profit limits of 10 and 12 percent respectively have been imposed on builders of ships and airplanes Regular plant facilities used in executing the contracts have been amortized in normal fashion while special facilities only of value for the particular contract could be charged as a cost in computing profits Determination of which class a given item fell into was done by the Treasury and manufacturers (and Army and Navy officers) complained that the Treasury was unduly strict

Last month when Congress passed the bills expediting defense (AM July 10 p 514) it continued this system but reduced allowable profits to 8 while putting amortization determinations in the hands of Army and Navy The affected industries let out a howl and contract negotiations promptly bogged down in fiscal red tape

Last straw was probably the Packard directors' qualms about taking the Rolls Royce contract At any rate Treasury Army Navy and Congressional leaders got together this month and came out with an announcement that the war profits tax legislation soon to be presented to Congress would absorb the Vinson-Trammel regulations in a general profit limit affecting all industries rather than just two Amortization of defense-expanded plant moreover would be put on a liberalized basis with a term, probably of five years

This meant that the accounting machinery already set up was obsolete Until Congress acts on the tax law no one can know how much profit he will be allowed or what items he can consider as a cost in computing the amount of his contract and his profits

H. Disston & Sons, Saw Makers, Celebrate 100th Anniversary

Henry Disston & Sons Inc, Tacony Philadelphia, Pa, is celebrating the 100th anniversary of the founding of the company Although as a pioneer saw manufacturer in the United States Disston's 65-acre plant has been geared to top production—5,000,000 saws and blades a year—to fill government orders in the national defense program, company officials have planned tribute to the memory of Founder Henry Disston

Henry Disston was 21 years old when he founded the business in the basement of his Philadelphia home at a time when most saws were be-



Greetings— *Former associate, 83-year old Luke Fraser, center is being welcomed by president Henry Disston right as vice president J Disston Is looks on Mr Fraser took part in the celebration*

ing imported from England Today the organization produces 2 000 products which are sold in 68 different countries In addition the company maintains branches in Toronto, Canada, Sydney Australia, and Seattle Washington

The officers of the company are S Horace Disston, president, W D Disston vice-president, and Jacob S Disston vice-president William L Disston Jr, the first of the fourth generation of the Henry Disston family, is being trained in the shops

TOOL ENGINEERS JOIN A.S.A.

NEW YORK—The American Society of Tool Engineers has become a Member-Body of the American Standards Association and will be represented on the Standards Council and Mechanical Standards Committee

Since the tool engineer is the man responsible for the production of ideas conceived by designers he is particularly interested in the national standardization program

U. S. Government Contracts Awarded to Metal-Working Industry in 1940-1941

Contractor	Govt Agency	Commodity	Amount
Standard Pressed Steel Co Jenkintown Pa	Ordnance	Ammunition parts	$15 760
Minneapolis Honeywell Regulator Co Minneapolis Minn	Ordnance	Fire control instruments	200 711
Lundquist Tool & Mfg Co Worcester Mass	Ordnance	Fire control instruments	50 450
International Harvester Co Chicago Ill	Ordnance	Heavy tractors	2 272 500
Allis Chalmers Mfg Co Milwaukee Wis	Ordnance	Heavy tractors	497 277
United Shoe Machinery Co Boston Mass	Ordnance	Guns	1 316 200
Remington Arms Co Inc Bridgeport Conn	Ordnance	Cartridges	890 775
Gilbert and Barker Mfg Co Springfield Mass	Ordnance	Fire control instruments	721 594
Eastman Kodak Co Rochester N Y	Ordnance	Fire control instruments	250 582
Lundquist Tool & Mfg Co Worcester Mass	Ordnance	Fire control instruments	50 450
Minneapolis Honeywell Regulator Co Minneapolis Minn	Ordnance	Fire control instruments	208 007
Bendix Aviation Corp Eclipse Aviation Div Bendix N J	Ordnance	Fire control instruments	1 013 055
Bausch and Lomb Optical Co Rochester N Y	Ordnance	Fire control instruments	405 150
Koppers Co Bartlett Hayward Div Baltimore Md	Ordnance	Gun carriages	3 721 940
Aetna Standard Engineering Co Youngstown Ohio	Ordnance	Gun carriages	1 302 130
General Electric Co	Ordnance	Howitzers pack	554 584
National Pneumatic Co Rahway N J	Ordnance	Guns	1 897 468
The Warner & Swasey Co Cleveland Ohio	Ordnance	Lathe turret universal	21 043
York Safe & Lock Company York Pa	Ordnance	Gun mounts	1 324 062
Standard Pressed Steel Co Jenkintown Pa	Ordnance	Cores for bullet	804 800
Russakov Gun Company Chicago Ill	Ordnance	Ammunition	117 300
Bridgeport Thermostat Co Inc Bridgeport Conn	Ordnance	Ammunition	118 167
Karp Metal Prods Co Inc Brooklyn N Y	Ordnance	Radio cabinets	206 010
James Cunningham Son & Co Rochester N Y	Ordnance	Machine gun assemblies	215 180
Universal Crusher Company Cedar Rapids Iowa	Ordnance	Machine gun assemblies	92 400
Stewart-Warner Corp Chicago Ill	Ordnance	Fuze units	222 625
Lollak Mfg Co Arlington Va	Ordnance	Fuze units	149 760
Fort Pitt Bedding Co Pittsburgh Pa	Ordnance	Fuzes	366 800
Kreuffel & Esser Co Hoboken N J	Ordnance	Elbow telescope	2 768
Bendix Aviation Corp Marine Division Brooklyn N Y	Ordnance	Fire control instruments	75 046
Stewart Motor Co Washington D C	Ordnance	[illegible]	60 868
Yellow Truck & Coach Mfg Co Pontiac Mich	Ordnance	70 Truck	9 116
Fargo Motor Corp Detroit Michigan	Ordnance	Trucks	81 537
Marmon Herrington Company Inc Indianapolis Ind	Ordnance	1182 Truck	899 715
The Corbett Co Henderson N C	Ordnance	24 Trucks	99 678
Fairchild Aviation Corp Jamaica N Y	Ordnance	29 Trailers	30 124
Yale & Towne Mfg Co Stamford Conn	Air Corps	Aircraft motors	168 [illegible]
General Bronze Corp Long Island City N Y	Air Corps	Fuel pumps	123 [illegible]
Ruberman Motors Corp Cincinnati Ohio	Air Corps	Propeller dolly assemblies	4 652
The Trailer Co of America Cincinnati Ohio	Air Corps	Truck tractor	175 482
Pioneer Instrument Div Bendix N J	Air Corps	Truck tractors	40 780
Bendix Aviation Corp South Bend Ind	Air Corps	Draft motors	0 000
Eclipse Aviation Div Bendix N J	Air Corps	Wheels and brake	11 464
The Heald Machine Co Worcester Mass	Air Corps	Starter assemblies	620 40
The Vought Aircraft Corp Dayton Ohio	Air Corps	Cylinder grinder	9 980
The Seifert Eisler Machinery Co Dayton Ohio	Air Corps	Maintenance assemblies	266 250
Pratt & Whitney West Hartford Conn	Air Corps	Honing machines	258 642
Sperry Gyroscope Co Inc Brooklyn N Y	Air Corps	Lathes	52 199
The Heil Co Milwaukee Wisconsin	Air Corps	Parts for automatic pilots	49 200
Air Associates Inc Garden City N Y	Air Corps	Trailer and dollies	200 675
Hamilton Standard Propellers East Hartford Conn	Air Corps	Airplane mooring kits	2 730
Fairchild Aviation Corp Jamaica N Y	Air Corps	Propeller assemblies	198 000
Hayes Industries Inc Jackson Mich	Air Corps	Cameras	213 028
The Hamb Tool Co Los Angeles Calif	Air Corps	Wheel and brake assemblies	257 757
Curtiss Propeller Div Clifton N	Air Corps	Tools and equipment	51 427
Holtzer Cabot Elec Co Boston Mass	Air Corps	Propeller assemblies	429 100
Leach Company Oshkosh Wis	Signal Corps	Telephone and parts	537 760
The Dicke Tool Co Inc Downers Grove Ill	Signal Corps	Reel Units	378 160
Stromberg Carlson Telephone Mfg Co Rochester N Y	Signal Corps	Reel Units	114 983
Sperry Gyroscope Co Brooklyn N Y	Signal Corps	Switchboards	399 966
American Car & Foundry Co New York N Y	Engineer Corps	Searchlight units	821 679
Bausch & Lomb Optical Co Rochester N Y	Engineer Corps	Tank cars	193 291
General Electric Co	Engineer Corps	Mapping equipment	62 837
Fate Root Heath Co Plymouth Ohio	Engineer Corps	Searchlights	49 782
International Stacey Corp Columbus Ohio	Engineer Corps	Locomotives	51 902
	Engineer Corps	Searchlight towers	20 940

$100,000,000 ARMS EXPORTED

WASHINGTON—From the State Department comes the announcement that a total of $100 063 870 68 worth of arms, ammunition, and implements of war have been exported from the United States during the year 1940, including May The largest buyer of war materials was France with $53,712,110 50, Great Britain was second with $13,335,081 15, Australia was third with $8,472,739 62 Other heavy buyers were Finland, $5,096,837, Canada, $2,657,524, China, $2,421,758, Netherlands East Indies, $2,349,644; and Turkey, $1,705,800

NAMES in the NEWS

J. Carlton Ward, Jr., has been elected president of Fairchild Engine & Airplane Corp. Until recently, Mr. Ward was vice-president of United Aircraft Corp. and general manager of its Pratt & Whitney Div., posts which he has held since November, 1938. Sherman Fairchild, former president, resigned to become chairman of the board.

Charles H. Chatfield, director of research of United Aircraft Corp., East Hartford, Conn., since 1935, has been appointed executive assistant to the vice-president. Succeeding Mr. Chatfield as director of research is Frank W. Caldwell who, since 1935, has been engineering manager with the Hamilton Standard Propellers Div. At the same time, Earle Martin, formerly chief engineer of the Hamilton Standard Propellers Div., has been appointed engineering manager to succeed Mr. Caldwell.

New appointments at the Vought-Sikorsky Aircraft Div. in Stamford, see Joseph M. Barr as factory manager, and James J. Gaffney as assistant treasurer and division accountant. The latter succeeds E. H. Glaettli who will continue as an assistant secretary. William R. Robbins, now assistant general accountant of United Aircraft Corp., will succeed Mr. Gaffney as assistant treasurer and assistant secretary of the Pratt & Whitney Aircraft Div.

J. E. Stanton, associated with the Republic Steel Corp. since 1912, has been appointed assistant to the president of the Aviation Mfg. Corp.

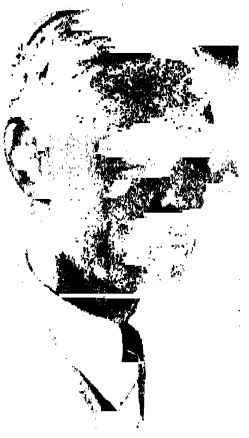
W. C. Morgenstern has been appointed assistant chief engineer at Copperweld Steel Company's new plant at Warren, Ohio.

John H. Alfes, who 21 years ago began his career in the engineering and production end of the automobile industry, has been appointed chief inspector of Olds Motor Works to succeed K. C. Plasterer, who will handle special assignments in the future.

John M. Price, for the past five years vice-president of Ferro Machine & Foundry Co., an affiliate of Oglebay, Norton & Co., was elected president by the board of directors. Henry B. Myers, factory manager for the company during the last six years, was elected second vice-president. Mr. Price succeeds the late James S. Leitch.

John F. Lebor, recently with the RKO Corp., has been appointed assistant to the executive vice-president of the York Ice Machinery Corp., York, Pa.

Heads Fairchild



J. CARLTON WARD, JR.

Advanced by United Aircraft



FRANK W. CALDWELL



CHARLES H. CHATFIELD

William W. Barnes, manager at Philadelphia of Air Reduction Sales Corp., has retired after 30 years of active work in the industry.

W. Leslie Lawrence has been elected secretary of the Alexander Milburn Co., Baltimore, Md. Mr. Lawrence, who became one of the company's directors a short time ago, succeeds the late Mr. Harvey H. Johnson.

PLANT EXPANSION

Edo Aircraft Corp., College Point, N. Y., will build immediately a $125,000 addition to its plant. This will increase the firm's space for manufacture of pontoons for sea planes from 20,000 to 40,000 sq. ft.

Curtiss-Wright Corp. will erect a new plant for the manufacture of airplane propellers at Caldwell, N. J. The new plant, which is scheduled to be completed by September will be a one-story steel and brick structure with 230,000 sq. ft. of floor area, and the new unit will make the Curtiss Division one of the world's largest manufacturers of aircraft propellers.

Warner & Swasey Co., Cleveland, Ohio, manufacturer of turret lathes, has just completed a new addition to their plant.

U. S. Spring & Bumper Co., 4951 Magnolia St., Los Angeles, Calif., is building a new addition to its factory. The expansion will cover an area of 75 x 240 ft. and will cost $18,000.

Air Transport Mfg. Co., Los Angeles, Calif., will erect a new aircraft factory building at Dougherty Field, Long Beach, Calif. The extension will cover an area of 30,000 sq. ft., and will cost approximately $65,000.

George Gorton Machine Co., Racine, Wis., has completed a 12,000-sq.ft. factory addition to house its assembly and shipping departments.

SKF Industries, Inc., Philadelphia, Pa., is planning construction of a 226,000-sq.ft. plant to be devoted exclusively to the manufacture of antifriction bearings.

Cleveland Punch & Shear Works Co., Cleveland, Ohio, has boosted its production capacity by 50 per cent with equipment now installed in the 34,000-sq.ft. addition which added 25 per cent to its floor space.

Micromatic Hone Corp., Detroit, Mich., has moved its entire organization into larger quarters. Expansion represents an increase of approximately 75 per cent in employees and over 100 per cent in space occupied during the last 18 months.

Huebsch Mfg. Co., Milwaukee, Wis., has purchased the General Bronze Corp. plant, which will more than double the company's factory space.

Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., is putting into operation what is claimed to be the world's most modern plant for the production of coated rods for electric welding. The plant will have a capacity about four times as great as the previous output level.

Lockheed Aircraft Corp., Los Angeles, Calif., is planning a $4,000,000 expansion program which will more than double its present facilities.

Douglas Aircraft Co., Santa Monica, Calif., is planning a $2,000,000 plant expansion program.

Brewster Aeronautical Corp., Long Island City, N. Y., has more than doubled its total floor space by leasing the assembly plant of the Ford Motor Co. of that city.

SALES

J. R. Kumer, Jr., has been appointed manager of stainless bar and wire sales for Allegheny Ludlum Steel Corp., Pittsburgh, Pa. Truman B. Brown has been made manager of Ludlite sales, with headquarters at Watervliet, N. Y., while Louis F. Lippert has been appointed manager of Pluramelt sales, with headquarters in Pittsburgh.

D. J. Henecker and C. E. Kendall have been appointed assistant managers of wire products sales for Jones & Laughlin Steel Corp., Pittsburgh, Pa. Mr. Henecker will be in charge of wire rope sales, while Mr. Kendall will head sales of wire and galvanized sheets. Consolidation of the company's wire rope sales division with its wire products division, under J. E. Timberlake, present manager of wire products sales, has been effected.

Thorvald L. Haines has been appointed Chicago district manager for William Jessop & Sons, Inc., New York, N. Y.

A. I. Richardson has been appointed Dallas, Tex., manager for Allis-Chalmers Mfg. Co., Milwaukee, Wis.

Fred L. Lawrence has been appointed Detroit district manager for Copperweld Steel Co., Warren, Ohio.

George W. Person, sales engineering department of the Norton Co., Worcester, Mass., has been transferred to St. Louis for special grinding wheel field service. J. L. de Vou, Jr., and George L. Freeman have been appointed field engineers of the Cleveland and Chicago districts respectively.

E. H. Anchors has been appointed Oklahoma City district sales manager for Air Reduction Sales Co., New York, N. Y.

G. B. Flanigan has been appointed New York district manager for Chain Belt Co., Milwaukee, Wis. He succeeds W. H. Quinn, who died recently after seventeen years association with the company.

George Campbell has been appointed manager of the Buffalo, N. Y., office of General Electric Co., Schenectady, N. Y. He succeeds George H. Calkins, who has retired after 41 years of service with the company. Ralph M. Darrin has been named manager of the Syracuse office, E. H. Aussicker has been made manager of the Schenectady office, and E. B. Currie has been named manager of the Binghamton office.

T. E. Cook has been appointed Chicago, Ill., sales representative for Jessop Steel Co., Washington, Pa. J. W Stranahan has been appointed to the Cleveland, Ohio, district. C. E. Spragg, formerly in the New York office, has been transferred to Hartford, Conn.

R. T. Stemdorf has been appointed Chicago district manager for Chain Belt Co., Milwaukee, Wis.

R. J. Stemdorf has been appointed district manager of the Chicago office of Chain Belt, Milwaukee, Wis. Mr. Stemdorf has been associated with the company since his graduation from college in 1924.

L. W. Sloan, 408 Olive St., St. Louis, Mo., has been appointed district sales representative in St. Louis, Missouri, and vicinity for the complete line of Trico Fuse Mfg. Co., Milwaukee, Wis.

BUSINESS ITEMS

Allmetal Aircraft Co., Inc., has been organized in Los Angeles, Calif., with a capital of $500,000. Miller, Peck & Miller, 222 Grosse Bldg., Los Angeles, will represent the new corporation.

Corsby Aircraft Corp. has been formed in Los Angeles, Calif., with a capital of $100,444. Orville A. Rogers will represent the new corporation at 1212 Commercial Exchange Bldg., Los Angeles, Calif.

With a capital of $1,500,000 National Aviation, Inc., has been organized in Los Angeles, Calif. Directors are: Leon Kaplan, M. H. Livingston and E. Burger, all of Los Angeles. The new corporation will be represented by Kaplan & Kaplan, 6253 Hollywood Bldg., Los Angeles, Calif.

Van Norman Machine Tool Co., Springfield, Mass., has purchased the Metal Saw & Machine Co., also of Springfield. The band saw business of the new acquisition has been sold to the L. S. Starrett Co., Athol, Mass.

R. S. Stokvis & Sons, Inc., New York, N. Y., are in a position to handle any accounts in the Netherland East Indies for companies which have lost contact with their foreign representatives because of war developments.

With a capital of $500,000, the Wesyn Aircraft Co., Inc., has been organized in Los Angeles, Calif. The new concern will be represented by William E. Gunason, 1010 Alvira St., Los Angeles, Calif.

Cutler-Hammer, Inc., Milwaukee, Wis., is moving its Pittsburgh, Pa., office to new and larger quarters at 355 Fifth Ave.

Michigan Tool Co., Detroit, Mich., has appointed C. Howard Eden, Los Angeles, Calif., to handle the Michigan line of gear finishing and lapping machines and "Sine-Line" checking equipment. D. E. Schellenbach, San Francisco, Calif., has been appointed representative for the northern half of California. In addition to machinery, Mr. Schellenbach will also handle the "Mitco" line of cutting tools.

Cowles Detergent Co., Cleveland, Ohio, has appointed James H. Rhodes & Co., Long Island City, N. Y., and Chicago, Ill., as distributor for its line of anhydrous metal cleaners.

Joslyn Mfg. & Supply Co., Chicago, Ill., electrical equipment manufacturer, has purchased the William E. Pratt Mfg. Co., Joliet, Ill., roller bearing manufacturer.

Hill Clutch Machine & Foundry Co., has purchased the assets of the Acme Machinery Co., both of Cleveland, Ohio, to form a new corporation, the Hill-Acme Company. Officers of the new company are: Ralph Perkins, chairman; A. C McDaniel, president; Karl F. Bruch, vice-president; L. L Herrik, vice-president and general manager; Milo G. Firestone, treasurer, and John R. Short, secretary. The combined annual business of these companies exceeds $2,000,000 and working capital will exceed $1,000,000. The Acme Machinery Co. will continue to operate as a division of the Hill-Acme Co., as will the Cleveland Knife and Forge Co., and the Canton Foundry & Machine Co.

MEETINGS

American Institute of Electrical Engineers. Pacific Coast convention, Los Angeles, Calif., Aug. 26-30.

National Foreign Trade Council. Twenty-seventh national foreign trade convention, San Francisco, Calif., July 29-31.

Porcelain Enamel Institute. Fifth annual forum, University of Illinois, Urbana, Ill., Oct. 16-18.

Silver Bay Conference on Industrial Relations. Twenty-third annual meeting, Silver Bay on Lake George, N. Y., July 24-27.

Society of Automotive Engineers. National tractor meeting, Schroeder Hotel, Milwaukee, Wis., Sept. 24 and 25. Annual dinner, Hotel Commodore, New York, N. Y., Oct. 14.

SHOP EQUIPMENT NEWS

Profiling Machine Made by National Holds Work to Close Tolerances

All that the operator has to do in running one of the new profiling machines announced by National Broach & Machine Co 11457 Shoemaker St Detroit Mich is to load and unload the two work fixtures The machine is entirely automatic and holds finished work to a tolerance limit of 0 002 in No mechanical skill is needed to operate the machine The work performed in this machine is strictly a profiling operation, and is not to be confused with three-dimensional duplicating Profiling is restricted to the milling of profiles internal or external flat or undercut on parts having a profile pattern not larger than 6 x 8 x 2 in thick where the cut is ½ in deep or less on a face ½ in wide or less

The principal field of application for this Red Ring profiler lies in the manufacture of parts for small arms and artillery breech mechanisms the duplication of all kinds of flat cams the profiling of airplane pistons and connecting rods to reduce weight the production of instrument parts accurate machine parts and electrical equipment parts

The machine utilizes a closed differential hydraulic circuit to actuate its movement This is claimed to assure freedom from chatter and to give greater responsiveness to directional changes of the guide pin This system includes a hydraulic pump which actuates the pistons by drawing a measured amount of fluid from one side and transferring it to the other A second pump maintains and regulates the amount of pressure in the system

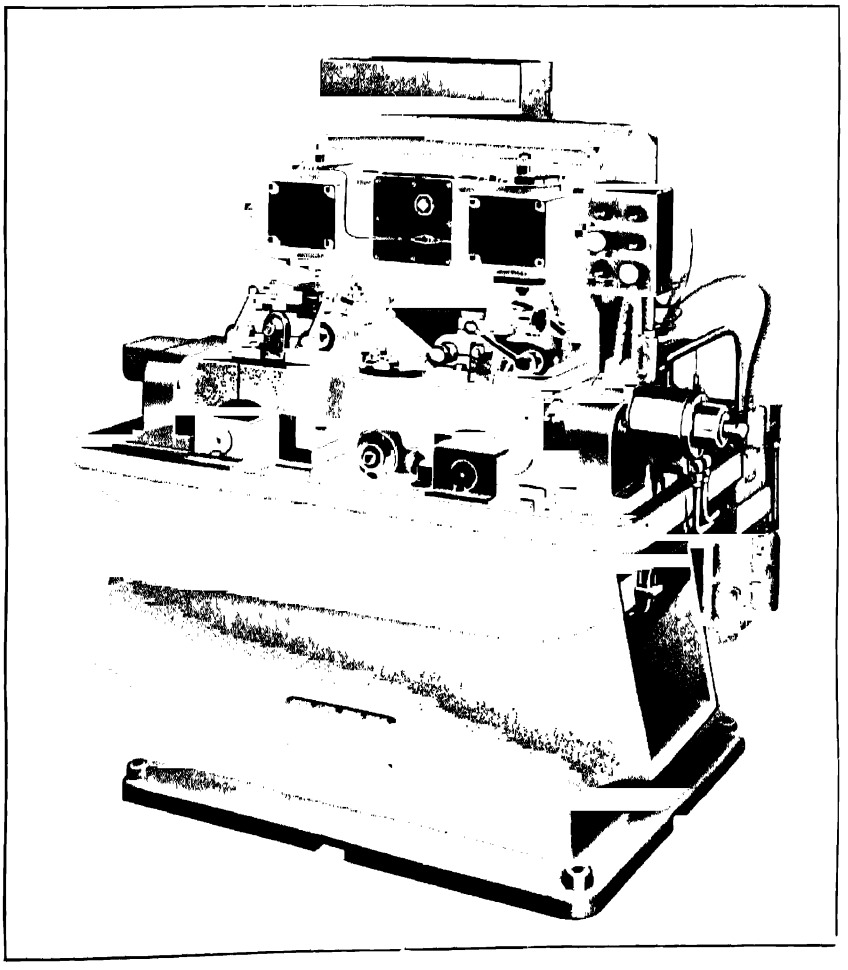
The work table which carries two work fixtures moves laterally The spindle head of the machine which carries two spindles one for each work station moves at a right angle to the direction of table movement These two principal movements are both reversible and each is actuated by its own hydraulic cylinder When the spindle head cylinder is working under feeding pressure the table cylinder is working under holding pressure and vice versa Change from feeding pressure to holding pressure is obtained by dogs which operate limit switches

A master pattern or cam the exact size and shape of the finished work part is mounted rigidly to the bottom of the work table A guide pin integral with the spindle head extends upward under the table to contact the periphery of the master cam Location of this mechanism beneath the table avoids errors caused by chips and dirt

When the machine is put into motion the guide pin traces around the periphery of the master cam Its motion is guided by maintaining the cam and guide pin in contact by means of changes from feeding pressure to holding pressure from point to point in its path as required by the shape of the pattern being profiled

Cutter spindles are individually motor driven Vertical adjustment is provided on the spindles to allow for slight variations in tool adjustment The tapered guide pin is adjusted vertically by a graduated dial to compensate for cutter wear Force feed lubrication is provided to all bearings and slides

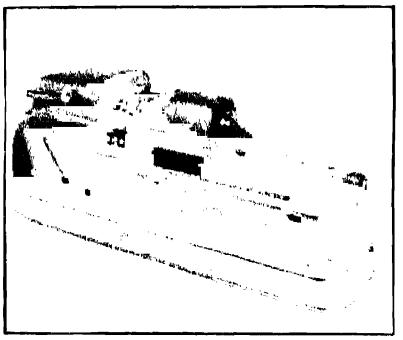
The work table carrying the holding fixtures and the master profile cam is of ample proportions to accommodate large fixtures Keyways and T-slots are provided for locating these fixtures



Unit "Polymatic" Former Makes Precision Parts

The Polymatic high speed wire forming and cut-off machine was developed by the Unit Machinery Co Rockford Ill for the production of small precision screw machine parts The following machining operations, or a combination of them are obtainable stock feed to fixed or swinging stop forming and cut-off with two cross slide tools and one or two end operations These end operations may be threading drilling box turning or turning with a swing tool and live pickup

The machine shown is equipped with a live pickup spindle which is geared to the main spindle A collet in the spindle nose chucks the part

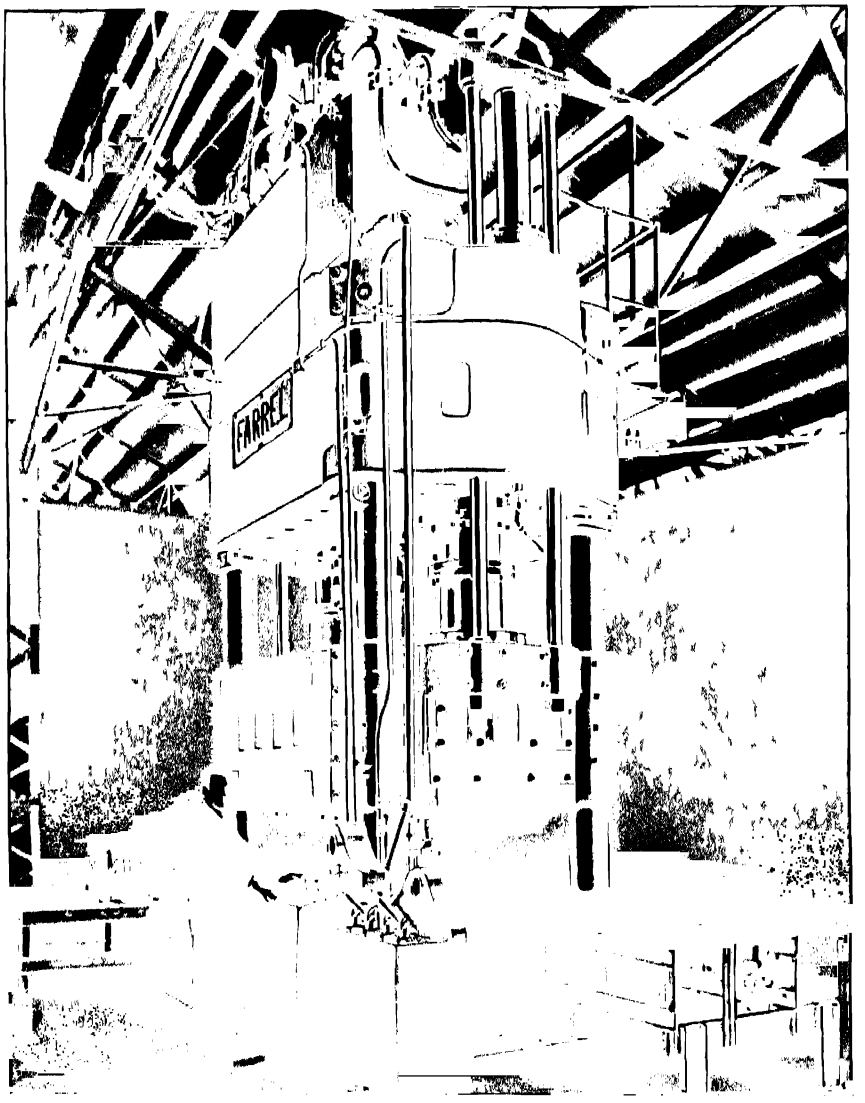


while being cut off and prevents the premature breaking off with a resultant burr As the collet opens in the pickup spindle the part is pushed through a tube inside the spindle The finished parts drop at the back end of the spindle entirely separated from the chips

Two models of this machine are available The No 01 handles wire stock to 5 32 in diameter and the No 11 machine will take stock up to $\frac{1}{2}$ in in diameter Both sizes of the machine are available either self-contained on a cast iron base or arranged for bench mounting The machines are motor driven and have pickoff gears for spindle speed changes and feed changes Spindle speeds of the smaller model range up to 15 000 r p m while the larger model has a maximum speed of 10 000 r p m

Farrel-Birmingham Hydraulic Press Forms Duralumin Aircraft Parts

A feature of a 2200 ton hydraulic press recently made for forming metal aircraft parts by Farrel-Birmingham Co Inc Ansonia Conn is the conveyor tables located on four sides of the press for loading and unloading purposes These conveyors keep the press operating at maximum capacity The tables each are equipped with a movable platen on which dies are mounted and carried into and out of the press The platens are controlled from a main control desk alongside the press control desk



Stroke of the conveyor cylinders is so arranged so that the platen registers uniformly on the press bolster Construction of the conveyors is such that they can be removed readily in the event that large dies occupying the full length and width of the press are to be used

The press weighs approximately 175 tons and stands nearly 26 ft high While the maximum capacity is 2200 tons under a hydraulic pressure of 2500 lb per sq in on one 38-in ram and two 20-in rams the pump control is designed so that a wide range of hydraulic pressures may be obtained by simple adjustment at the control panel Two 10-in diameter single-acting push-back rams raise the moving platen to the open position Dimensions of the clear space available between tie rods are 61 in wide and 97 in long Overall dimensions of the bottom crosshead and of the moving platen are 96 x 133 in Both the moving platen and the bottom crosshead are provided with T-slots running the width of the press and with machined surfaces for future addition of platen extensions to make the platen area 96 x 178 in

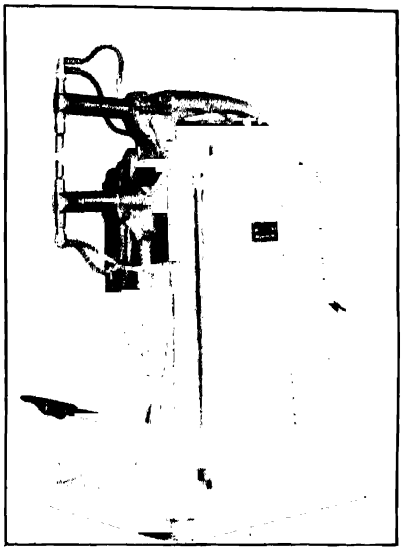
The press has a maximum opening of 60 in and a maximum stroke of 36 in Provision has been made to reduce the maximum opening to 38 in maintaining the 36 in stroke Closing speed is variable from 1 to 130 in per min with a pressing speed of from 1 to 12 in per min The traverse or return speed is approximately 130 in per min

Power generating equipment consisting of a motor-driven pump valves piping and oil storage tank is mounted on top of the press The hydraulic pressure pump is of the radial piston type with variable pressure control and is driven by a 150 hp 900 r p m motor The entire control of the press is effected from a control station located near a corner of the press This station has pushbuttons for starting the pump motor increasing and decreasing downward travel speed a manual control lever electric control levers for automatic operation of the press and a pushbutton to control the single cycle operation

A.E.F. Standard Welders Made in Three Frame Sizes

A line of standardized spot welding machines available on three sizes of frames has been announced by American Electric Fusion Corp 2610 Diversey Ave Chicago Ill Interchangeable parts are used wherever possible on the three sizes of these machines Each of the three frame sizes is sufficiently large to house either of two transformers Thus the Type BG welder with 10 kva capacity also houses the 15 kva

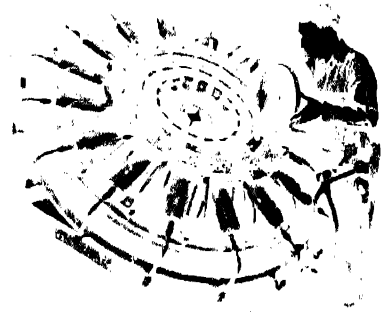
transformer of Type BH welder. The medium frame takes either the 20 kva. transformer of the Type BL welder, or the 30 kva. transformer of the Type BM welder. Similarly, the large frame machine has space for



the 40 kva. capacity transformer used in the Type BP welder, and the 50 kva. capacity for the Type BR welder. Horn lengths for various throat-depths are the only part of these welders to be added as orders are received. The most popular sizes of horn lengths are usually carried in stock so that shipment of these welders can be made promptly.

Progressive Punch Units Punch Sixteen Holes

High production speed, flexibility of individual punching units to permit rearrangement, elimination of cam dies, and constant air pressure method of piston return are features of a series of self-contained hydrau-

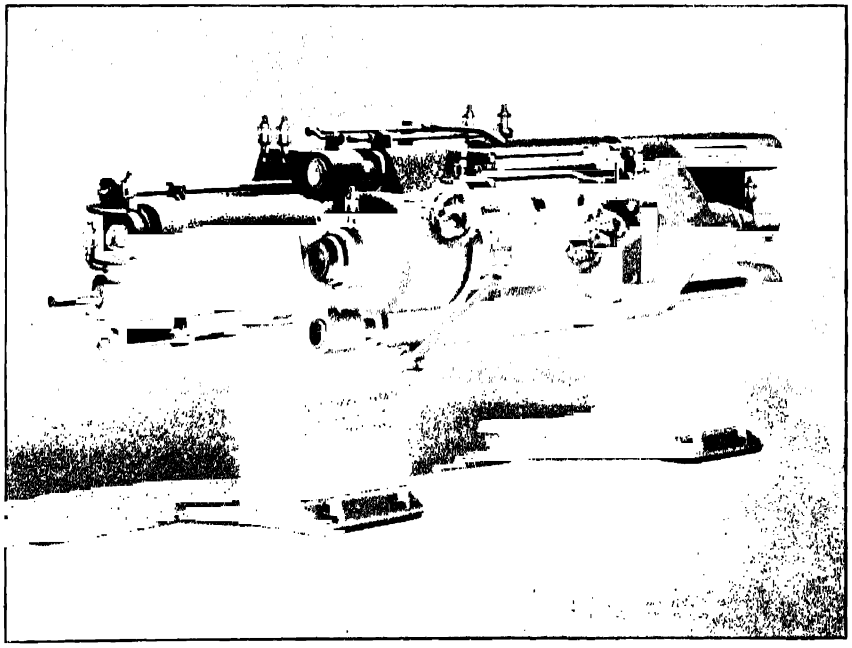


lic punching units, announced by Progressive Welder Co., 3001 E. Outer Drive, Detroit, Mich. In each unit there is a constant air pressure in the piston return chamber. During the punching stroke, this pressure is overcome by hydraulic pressure obtained through a separate pump. Release of the hydraulic pressure permits the air pressure to return the piston, thus eliminating spring return.

In the accompanying illustration, a group of the units is mounted on a radial type fixture designed to punch 16 holes simultaneously in a disk of ⅛-in. thick steel. The fixture is provided with a foot-actuated work ejector, facilitating removal of the punched part. Additional time is saved by using automatic work locators attached to the spring stripping plates which hold the part in position.

Prescott No. 11 Amalgamated Shell Turning Machine Uses Former-Controlled Contour Turning Attachments

Primarily a shell-turning machine, the No. 11 Amalgamated shell machine made by The Prescott Co., Menominee, Mich., and designed by Lucien I. Yeomans, is adapted to many other uses. The former-controlled contour turning attachments on this machine are adapted to carriages which travel axially along the work. The ways of the machine are cylindrical ground bars of high carbon steel, and are arranged in a vertical plane. They are 2 15/16 in. in diameter, and are spaced 22 in. apart. The frame is of cast iron, in a full box section, carried on two pedestals which may be cast integral or as separate elements of the structure.



A drive shaft, fully inclosed in the box frame, extends from end to end of the machine and has projecting key-seated ends upon which flexible coupling members may be mounted to connect several machines in a group by short spacing-shafts between the machines. The machines may be independently driven, if desired, and in such case motors on the floor drive to a pulley, sheave, or chain wheel located on one end of the shaft. These shafts are 1 15/16 in. in diameter, are mounted in Satco bearings, and normally are operated at 400 r.p.m. It is claimed that they can transmit approximately 100 hp.

Upon the ways is carried a longitudinally movable frame having a bearing length upon the ways of 59 in. This frame carries both the live and tailstock spindles and the whole frame travels with the work. The work is held between the live and dead centers by fluid pressure applied at the tailstock. It is driven by fixtures on the live spindle. The four-point mounting of the frame on the ways may be considered as comparable with an ordinary lathe carriage in which the extreme dimensions on the ways are represented by a 22 x 59 in. rectangle. The spindles are 3 15/16 in. in diameter, and the drive to the live spindle is direct, from a long pinion which is clutch controlled.

The tools used in this machine are longitudinally fixed in position and, in the case of a rough or straight turning operation, may be held in multiple tool holders arranged like a large hollow mill. The work carried through such a tool head is straight turned. In the case of formed work the requirement is for a different tool head upon which oppositely mounted cutting tools are radially movable under the control of a former. All tool heads are located by male and female engaging surfaces

upon a rigid tool carrier arm which is cast integral with the box frame of the machine

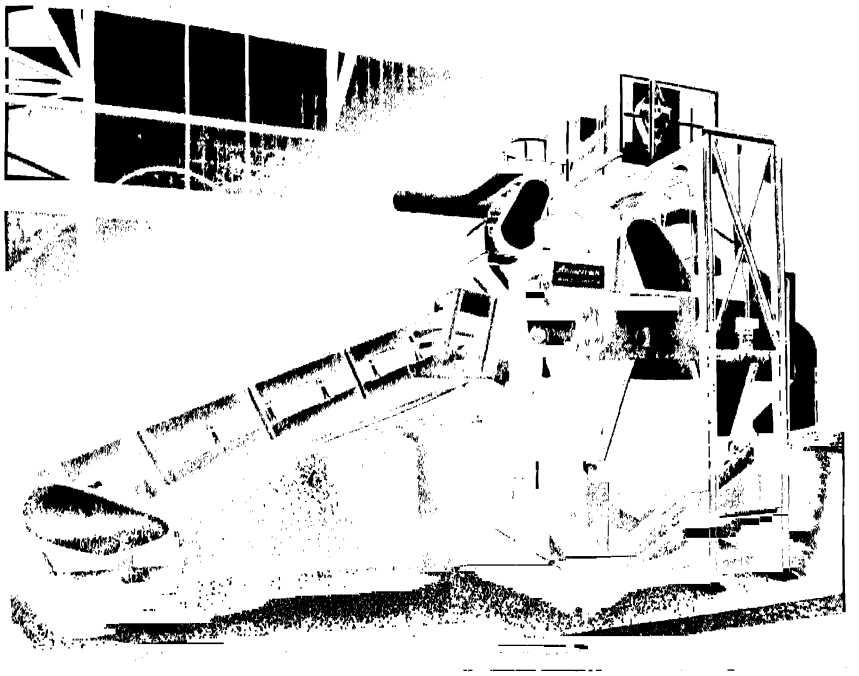
The former used is a circular section at all points rather than the usual flat surface and it is the reverse of the work to be produced It is generated by using a model of the part as a master former Two rollers one on each side of the former engage it and by increase or decrease of their center distances under the control of the former the tools are advanced or retracted relative to the axis of the work This makes possible the use of tools on opposite sides of the work to machine the same contour Thus, a fine increment of cut per tool may be secured with double the total feed which would be possible with ordinary formers and single tools The tools are separately controlled by the circular former

To change from a formed job to a straight turning job involves only the change of the former tool head to a rigid tool head, or the straight form may be turned with the former tool head by using a straight instead of a contoured former The machine is operated by inserting the work to be turned between the live spindle driving fixture and the tailstock center, when the movable frame is at the left position of travel and the spindle is at rest The tailstock center is advanced by operation of the fluid pressure piston and the spindle clutch lever and feed lever are thrown into engagement At the completion of the cutting operation, the feed automatically stops and the spindle is stopped, the tailstock center is withdrawn, and the work removed from behind the tool head The feed lever then is thrown into reverse and the rapid traverse returns the movable frame to position for another cycle of operation

Capacity of the machine is for shells from 75 to 105 mm, and it will machine such unusual contours as the 81 mm "avocado" shell The time estimated for a 105 mm shell, with appropriate tooling, is 1 min For shorter shells of less diameter, the time is proportionately less The design of this machine is such that chip disposal is not a problem, even when using carbide-tipped tools The space directly below the spindles and tools is entirely clear, and it is possible to use floor chutes chip crushers or conveyors, as desired, to handle the chips Actual offset of the center line of the spindles from the face of the box sectioned frame is 11½ in Weight of this machine is approximately 5,500 lb

American Continuous Wheelabrator Tumblast Regulates Tumbling Speed and Flow of Work

The continuous Wheelabrator Tumblast cleaning unit developed by the American Foundry Equipment Co, 555 Byrkit St, Mishawaka, Ind, is made in various sizes for a wide range of type and size of work Using a combination of tumbling and longitudinal travel of work, together with a double width blast from a wide Wheelabrator, this machine is claimed to surpass in productive capacity any previously offered barrel type blast equipment The desired cleaning of all parts is made possible by tilting the mill to the proper angle, by varying the speed of the tumbling barrel, and by using the proper abrasive In order to insure full exposure of work to the blast, both the angle of the barrel and the speed of the apron are made variable, as different types of work require different longitudinal speed and tumbling speed within the barrel.



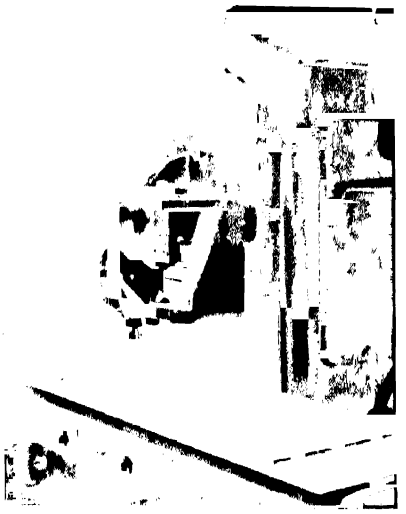
Any conveyor system can be used for feeding parts to the cleaner and the cleaned castings can be discharged into tote boxes or onto a conveyor system The work to be cleaned is carried through the blast barrel on an endless apron-type conveyor which constantly tumbles and cascades the work, thereby completely exposing all surfaces of every piece to the full effect of the abrasive blast

In the Wheelabrator process, abrasive from an overhead storage hopper is fed by gravity through a chute and control case to the center of a wheel which rotates at high speed By centrifugal force the abrasive is thrown from the wheel upon the product being cleaned or prepared A cast alloy impeller rotates with the wheel proper and carries abrasive to an opening in the stationary control cage where it discharges to the blade section of the wheel At this point, the abrasive is picked up by the inner ends of the throwing blades and gradually is accelerated in its passage to the periphery of the wheel The final throwing velocity is the result of radial and tangential forces Change in direction of the blast is attained by turning the control cage which changes the position of the opening Any type of finish can be obtained on the work by the proper selection of size and type of abrasive Light metal parts can be given a satin finish or sand and scale can be blasted from castings forgings, heat-treated parts, stampings and similar products

Aber Cherrying Attachment Fits Most Milling Machines

A cherrying attachment offered by Aber Engineering Works, 1613 Flett Ave, Racine, Wis, fits both vertical and horizontal milling machines of most types, and makes it possible to cut sharp corners, channels, undercuts, hollows and concave areas in dies and odd shapes to a variety of depths and diameters A standard cutter is used for roughing work then to remove the final 0 015 to 0 020 in, a special cherrying cutter is used

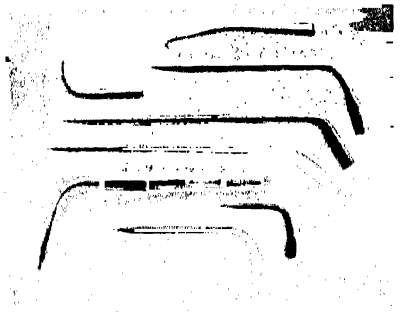
The attachment is graduated for adjustments around 360 deg and each unit has an individually calibrated scale to determine work angles The only part requiring lubrication in this attachment is the worm driving gear, which should be grease-lubricated every three months Two bolts loosen the cutter driving gear housing to accommodate different diameter cut-



ters Cone pin bearing points can be separated to accommodate cutters from ¼ to 3 in in width Special form cutters for finishing odd shaped work can be used in this attachment

"Ang-Lite" Units Illuminate Deeply Recessed Areas

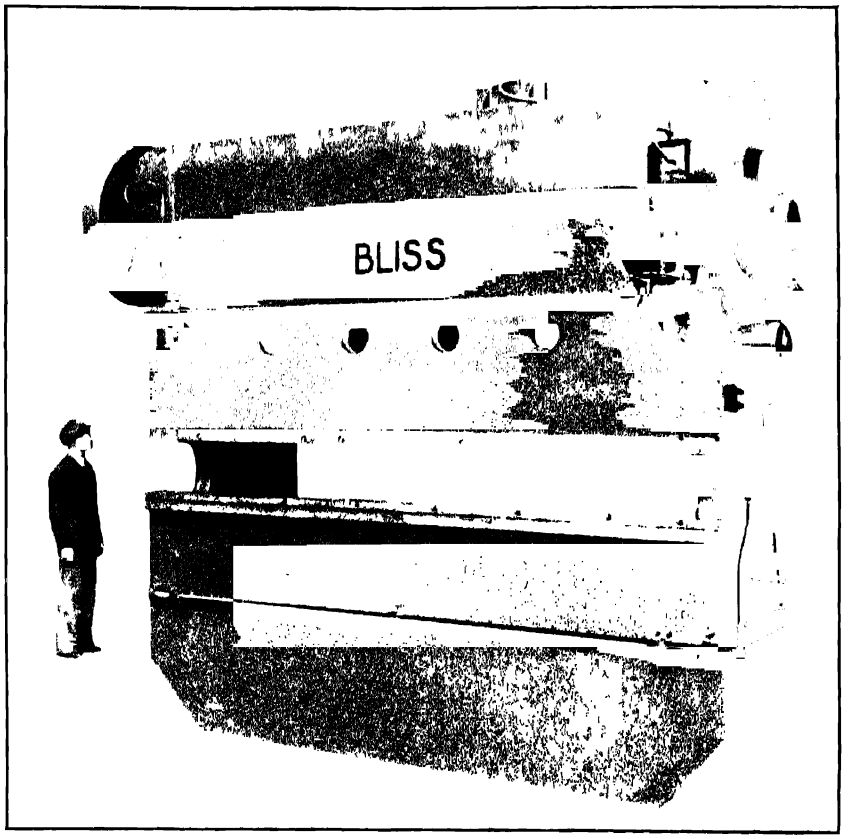
Designed to provide light at various angles in deeply recessed areas where careful inspection is necessary Ang-Lites made by Diagnostic Ultra Lite Co 170 Broadway New York N Y are fabricated from Lucite They are hand-tooled and are said to be practically unbreakable They are made in various stock shapes and sizes with ⅜ 1 and ⅝ in diameter at the threaded end The handle of the Ang-Lite unit is a specially designed pocket flashlight



unit with a telescopic metal sleeve which shields the light source and contains removable reducing bushings into which are screwed the threaded end of the Lucite shapes When in operation there is approximately 50 to 75 candle power of light at the point or tip varying with the lengths and degree of the angle Electric units available with a small plug-in type transformer equipped with a 7 ft cord and switch operating on a c only will give approximately 100 to 150 candle power of light The Lucite pieces are interchangeable from the pocket light unit to the transformer unit

Bliss Improved All-Steel Press Brakes Employ Electrically Operated Friction Clutch

Latest addition to the line of all-steel press brakes made by E W Bliss Co 53rd St and Second Ave Brooklyn N Y is the No E-12 machine shown It has a capacity of ¼ x 144 in in mild steel Deflection in the bed and slide is held to a minimum by generously proportioned beam members



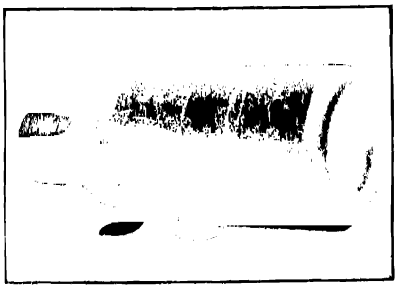
An electrically operated friction clutch designed especially for Bliss press brakes is employed on this machine Bronze bushings are used for the eccentric shaft and intermediate shaft bearing A V-belt motor drive is employed The intermediate gearing is lubricated by oil or grease in oil-tight housings Guards are employed to retain lubricants for the larger gears

Specifications for the brake shown are as follows distance between housings 150 in depth of gap 12 in stroke of slide 4 in, adjustment of slide by motor 6 in distance from bed to slide with stroke down and adjustment up 12 in speed of operation 30 strokes per minute

G. E. Speed-Variator Unit Provides Ranges to 16:1 Ratio

The General Electric Co Schenectady N Y has developed as a standard unit a complete speed-variator equipment operating from an a c source of supply to provide wide ranges of adjustable speed by means of the generator voltage control scheme Each equipment consists of an adjustable speed d c motor an adjustable voltage motor-generator set with control and a separately mounted generator-field rheostat Standard speed ranges are available up to 16 1 ratio

The adjustable-speed d c motor can be mounted directly on the driven machine with the speed-changing control mounted nearby The units are designed to operate from three-phase 60-cycle 220- 440- and 550-volt a c power The potenti-

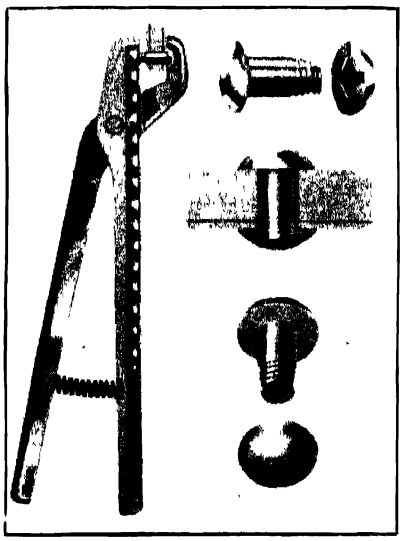


ometer-type generator-field rheostat provides speed changes in small increments over wide ranges. The speed variator is suitable for many industrial applications where adjustable speed has a direct bearing on control of quality and efficient output of the driven machine.

Hopkan Spring Fastener Will Not Vibrate Loose

An improved fastener with a spring locking button has been developed by Hopkan Rivet Co., 128-130 Latham St., Pittsburgh, Pa., for use in the same manner as present speed nuts and screws. It presents a finished appearance in exposed places. The spring locking button and fastener is so designed that it will not loosen from vibration when assembled.

The fastener stud, having a head

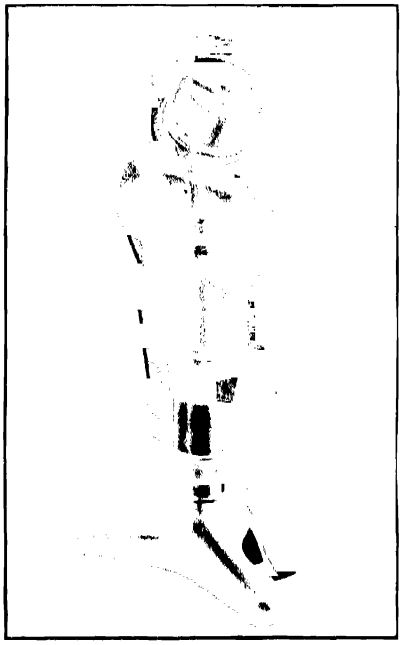


and shank, is inserted from one side of the assembly and the spring locking button, which can be made in any size or shape, is applied with a specially developed tool. The shank is tapered toward the end and is provided with a number of parallel grooves. A spring in the locking button engages the grooves in the stud to hold the assembly together. These fasteners can be made from any type of alloy.

FabriSteel Machine Sets "Fast-On" Lock Nuts

A special machine for setting "Fast-On" lock nuts where large-scale production is required, has been developed by FabriSteel Products, Inc., Kerr Machinery Bldg., Detroit, Mich. The nuts are fed from a continuous rotating hopper which has a capacity for 1,000 nuts of ¼-in. size. These nuts are fed to an anvil where the clutch is tripped and the "Fast-On" nut is locked into place. The machine has a speed of 200 r.p.m. and, on the assembly of small parts, it is claimed that 2,500 lock nuts easily can be set per hour.

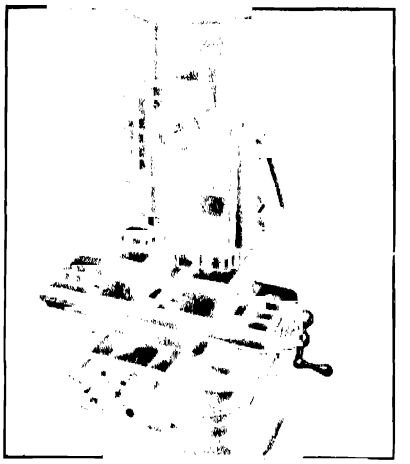
The machine has a non-repeating clutch, the crank is locked in dead center position and only then can the machine be tripped. As fast as a nut is locked into place, another nut is fed into position ready to be



installed. Height of working position above floor can be adjusted from 34 to 39 in., assuring the operator a comfortable working position. Safety anvil design eliminates the possibility of overloading the machine or stalling the motor.

Vernon Profiling Attachment Applicable to Contour Milling

A profiling attachment has been developed by Machinery Mfg. Co., P. O. Box 155, Vernon Branch, Los Angeles, Calif., for use on the Vernon combination vertical mill and jig borer. The sliding head of this attachment



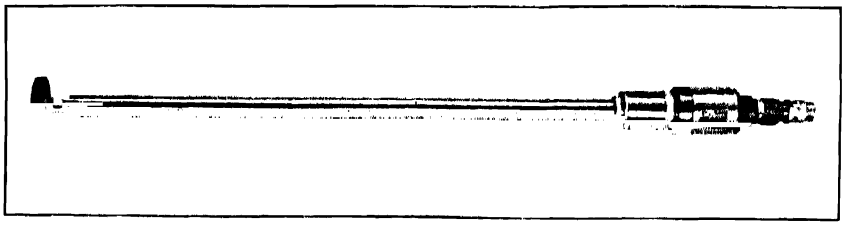
is so constructed that the attachment easily can be engaged and disengaged. The attachment was developed especially for small lot machining of irregularly shaped forgings, but it also is applicable to contour milling from wood, plaster or plastic models.

Atlantic Grinding Wheels Handle Difficult Metals

To meet the need for special grinding wheels for efficient use on the more difficult metals, Atlantic Abrasive Corp., 516 Pearl St., South Braintree, Mass., has introduced two new types of wheels. The Type L. A. is a hard-tempered wheel for general use on aluminum, copper, zinc, brass, iron, steel and stellite. Wheels made in the finer grain sizes of this type are claimed to be ideal for precision grinding. The Type S. C. is a soft-tempered wheel, made in all grain sizes from coarse to fine, and designed for fast, clean grinding of metals such as stellite, carboloy and alloyed steels. Both of these wheels are made with a new synthetic bond which is said to make them run cooler under the toughest grinding conditions. Clogging and glazing are said to be eliminated, as is the danger of burning.

Rotor Pneumatic Grinders Use Small Wheels

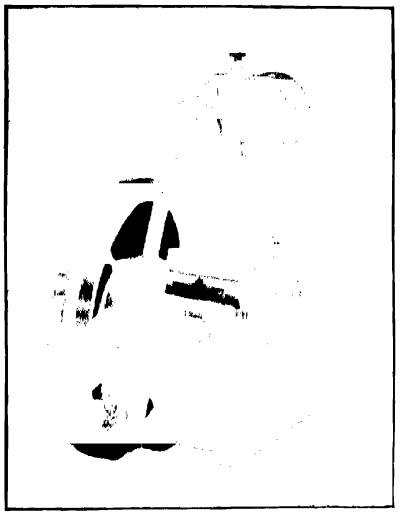
The Rotor Tool Co., 17325 E. Euclid Ave., Cleveland, Ohio, has announced two new production-type die grinders for use with wheels ranging from ½ to 2½ in. in diameter. The No. M-825 grinder shown features an extension of either 13 or 26 in. for cleaning up the inside of shells. The side to center clearance of this machine is reduced to ½ in., weight is 7 lb. The No. M-826 grinder is designed for getting into otherwise inaccessible places, the side to center



distance being only 19 32 in Speed of this grinder is 17,000 or 21,000 r.p.m.; weight is 2¼ lb Various types of handles, such as sleeve twist, spade, button safety or right-angle throttle, are used interchangeably on both of these grinders The manufacturer states that the motors of both units have ample power for holding high load speed for fast cutting and long wheel life.

Sullivan Type Q Compressors Have Cushioned Air Valves

The Sullivan Machinery Co, Michigan City, Ind, now is offering a group of small air compressors



known as Type Q units These compressors are air cooled, single and two-stage and range in capacity from 2 8 to 4 57 cu ft per min with operating pressures of 100 to 200 lb per sq. in under continuous loads The pressures under intermittent loads are 150 to 500 lb per sq in These Type Q compressors have cushioned air valves, a balanced crankshaft, taper roller main bearings, Lynite connecting rods, semi-steel pistons positive lubrication a copper intercooler, chrome nickel cylinders and a dust-proof crankcase Automatic starting can be furnished Units are available bare, base mounted or tank mounted, for V-belt drive from an electric motor or air-cooled gasoline engine Motor sizes range from ½ to 10 hp

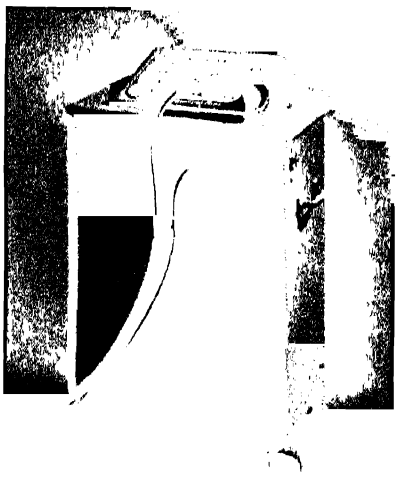
Crucible Offers "Rezistal" Stainless Steel Electrodes

"Rezistal" stainless steel electrodes developed by Crucible Steel Co of America, 405 Lexington Ave, New York, N Y for the electric arc welding of stainless steel, combine stainless base wire and a coating employing recent developments in flux coating composition These electrodes are of the extruded flux coated type, assuring concentricity of coating and stability of arc for all position welding The coating is designed to prevent oxidation of the weld metal, and to maintain virtually the same chemical analysis and physical properties of the deposited metal as of that in the parent metal The slag produced by the coating is easy to remove Six standard types of these electrodes are available for the various stainless steels They are available in diameters from 1 16 to ¼ in and in 9- 11-, and 14-in lengths

Ergolyte Arc Welders Have Glass Insulation

Two continuous a c arc welders have been made available by the Ergolyte Mfg Co, 3644 Lawrence St, Philadelphia, Pa All controls and sockets on these welders have been brought into full view on a sloped panel, eliminating the necessity for crouching to select heats or make adjustments Heats may be selected in gradual steps over a wide range Transformer insulation is double spun glass

These welders employ a broken wave current produced by a special transformer winding which, it is



claimed, makes them stable and quiet in operation regardless of how unsteadily the electrodes are held The No 160 model has a current range of 15 to 160 amp The No 250 welder shown has a current range of 15 to 250 amp. These welders operate on single phase or on one phase of two or three phase circuits

New Timken Bearing Series Are of Standard "SS" Type

The Timken Roller Bearing Co, Canton, Ohio, has put into production a new bearing series of the standard "SS" type The first bearing in this series is No 9285-9220, with a cone bore of 3 in, outside diameter of 6¼ in and width of 1½ in At 500 r p m this bearing has a radial capacity of 6,255 lb and a thrust capacity of 8,710 lb The Nos 9100, 9300, and 9000 bearings of the "SS" type have also been redesigned to reduce the outside diameters and width of each series while still maintaining the same load carrying capacities These series in addition to those now available in the "SS" type provide a wide range of capacities, varying in cone bores from ½ to 12½ in The "SS" series are single row bearings with steep cup and cone angles They are designed primarily to handle those loading conditions where thrust loads are large compared to the radial loads

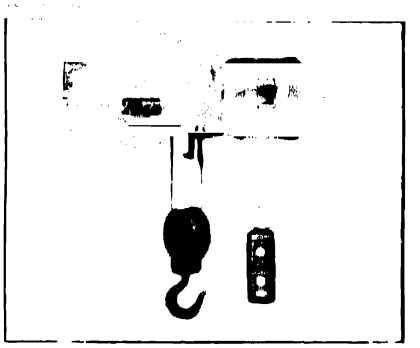
Guth Plastic Diffuser Made for Fluorescent Lamps

A plastic device which snaps on to a fluorescent lamp to reduce glare from bare lamps has been made available by the Edwin F Guth Co, 2615 Washington Blvd St Louis, Mo This device is called the "P-F-C" (plastic fluorescent channel) and is applicable for both 1- and 1 -in lamps These channels are available in five colors, white, light blue, yellow pink and pale green They are shatter-proof

Detroit "Titan" Hoists Plug in Lighting Circuits

The "Titan" electric hoist made in 250 500 and 750 lb capacities by Detroit Hoist & Machine Co, 8201 Morrow St Detroit Mich is a completely inclosed unit of compact construction made for lamp socket plug in, or for power circuits Hoisting speeds range up to 00 ft per min. They are made for hook or trolley suspensions

The hoist mechanism has only two



gear reductions, a cone worm of continuous area contact and a set of helical gears An electric solenoid brake capable of sustaining the full load is provided on the hoist motor

as standard equipment. This brake is fitted with molded brake liners and has a continuous duty solenoid. Independent of the solenoid brake, the locking action of the cone worm in the hoisting mechanism positively holds the load at any point

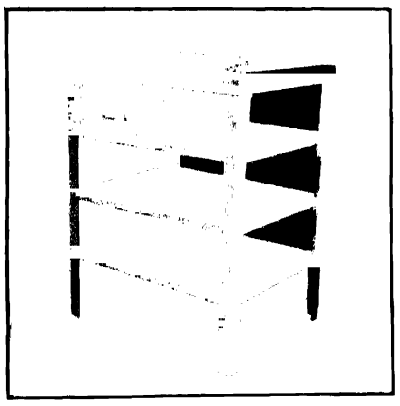
Emerson Electric Motors Have Pressed Steel Frames

A line of shaded pole electric motors in pressed steel frames has been announced by the Emerson Electric Mfg. Co., 2088 Washington Ave., St. Louis, Mo. These ventilated motors are available in two frame sizes, with capacities ranging from approximately 1/400 to 1/25 hp.

The small frame is furnished with a detachable strap base and the large frame can be furnished with rigid saddle base or resilient hub mounting. All ratings can be furnished without base, with extended through-bolts for stud mounting. Frames are equipped with self-aligning wool-packed, oil impregnated bearings. These motors are suitable for vertical operation, with shaft end up.

Stackbin Welded Bench Used Alongside Machines

All-welded steel construction gives this machinist's bench, made by Stackbin Corp., 42 Troy St., Providence, R. I., life-long rigidity without periodic tightening of bolts or rivets. Originally designed to be used alongside machines, the top of this bench is ⅛ in. thick steel, shelves are No. 14 gage steel, and legs are heavy angle steel. The bench can be equipped with a lock drawer, if desired. The model illustrated has a 20 x 24 in. top and is 30 in. high. These dimensions can be varied to suit individual requirements.



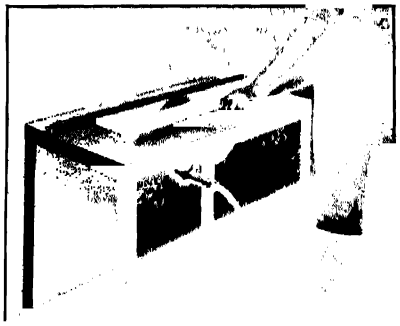
Bristol Pyrometer Controller Operates in a Vacuum

Moving parts in the control circuit, such as motors, depressor bars, toggle switches and open contacts, are eliminated in the electronic pyrometer controller developed by the Bristol Company, S. Main St., Waterbury, Conn. The pointer of the Weston millivoltmeter movement is not engaged or retarded at any point within its normal operating range, thereby leaving it free to continuously indicate the temperature under control. This measuring unit is equipped with a cold-end compensator, insuring high accuracy.

Control is accomplished by means of a new electronic circuit, using a single high-output vacuum tube of the all-metal type. A milliammeter on the front of the instrument indicates the condition of the control circuit at all times. Due to the use of a "Millivac" relay, the control is extremely sensitive to changes in temperature at the thermocouple. The entire operating mechanism of this relay is totally inclosed in a vacuum. A full description of the controller is given in Bulletin No. 544

Van Dorn Saw Table Holds No. 85 Quick-Saw

A portable saw table has been developed by Van Dorn Portable Electric Tools, Towson, Md., to convert the No. 85 Quick-Saw to saw table



use for maintenance operations. The saw table of the portable saw locks in place in the center of the table top and all depth and angle adjustments of the portable saw can be made in saw-table use. This table is made of heavy gage metal with demountable legs, an adjusting ripping guide and clamps to hold the saw in place.

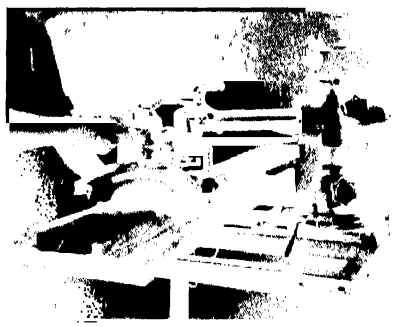
Small Vertical A.C. Motors Offered by Fairbanks-Morse

A line of integral horsepower, vertical, single-phase motor in sizes from ½ to 5 hp has been announced by Fairbanks Morse & Co., 600 S. Michigan Ave., Chicago, Ill. These motors, because of their electrical and mechanical characteristics, are claimed to be adaptable for operation in isolated localities where they will receive little attention. Design is such that dripping or splashing water will not reach vital parts under normal operating conditions. Operating speeds are 1200, 1800 and 3600 r.p.m. All 1800 r.p.m. and slower motors are built in the repulsion-start induction-run type. The 3600 r.p.m. ratings start as a repulsion motor, and as the speed rises, the imbedded squirrel-cage winding in the rotor picks up a large portion of the load automatically.

Porter-Cable Radial Arm Supports Speedmatic Saws

A radial arm unit for supporting "Speedmatic" electric hand saws has been developed by Porter-Cable Machine Co., Syracuse, N. Y. to speed maintenance operations. When a radial sawing machine is required, the shoe is removed from the Speedmatic saw, and the motor unit mounted on the radial arm.

This radial saw has several advantages: the arm moves back clear of the table so that stock can be arranged quickly for sawing, the arm



provides a stroke of 26 in., the rib guides may be placed to the rear so that stock 65-in. wide may be halved, and the arm may be raised 7½ in. by means of a large handwheel. The regular adapter permits tilting the saw unit 45 deg. A special adapter is available which will permit tilting the saw 90 deg. Cut-off capacity is 4½ in. deep with a 26 in. stroke.

Stearns Magnetic Separator Reclaims Metal Turnings

A double magnetic pulley separator unit, designed to separate brass and iron turnings and borings has been built by the Stearns Magnetic Co., Milwaukee, Wis. By combining two magnetic pulley separator units in one machine, rapid separating of these materials is effected. The top unit consists of a 15-in. diameter magnetic pulley, 30 in. wide with vanner edge belt and tail pulley, and the lower unit has a 12-in. by 30 in. magnetic pulley. The material is fed either into the bulk hopper or into the chute below. In the process of separation, the coarse material is picked up by the upper magnetic pulley, while the lower magnetic pulley unit serves as a refining or secondary separation. Long and odd-

BY *Simply* CHANGING TO CARBOLOY TOOLS . . .

Production Stepped Up 30%

ON MORE THAN 1000 MACHINING JOBS AT

GISHOLT!



Turning, facing, boring Hy-Ten B3X hot rolled steel lead gear—one of the several hundred Carboloy Tool STEEL CUTTING applications in the Gisholt plant

IMPORTANT—CARBOLOY TOOL APPLICATIONS AT GISHOLT ARE

80% STEEL CUTTING

Sharing in common with other leading machine tool builders the abrupt increase in demand that has caused the operating rate of that industry to soar from 52.5% in January 1939 to 92.5% in May 1940, Gisholt Machine Company early sought to more extensively employ cemented carbide tools as one means of increasing machining production.

To meet the problem of applying carbide tools economically on the small-lot, diversified work typical of the machine tool industry (as compared to continuous production applications), Gisholt adopted the following procedure:

1. A carbide "application man" was appointed within the plant to control all use and maintenance of carbide tools.
2. Ten basic styles of carbide tools were designed for general purpose use on 80% of the work in the shop.
3. Two grades of Carboloy—one for steel, one for all other metals—were selected for universal use.
4. A uniform method of carbide tool application was set up and adequate grinding facilities provided.

Result to date has been a 30% average increase in production on more than 1000 jobs to which Carboloy tools have been applied.

A 12-page booklet gives complete details. Write for your copy.

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AGAIN—the general purpose use of Carboloy tools on small-lot, diversified work . . . **PAYS DIVIDENDS!**

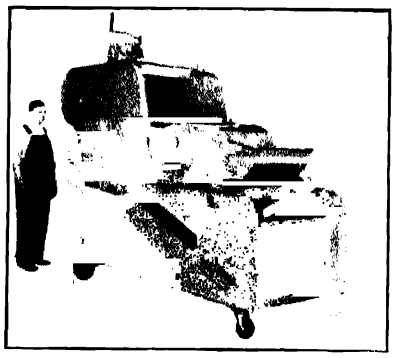
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The Mark of CARBOLOY

TUNGSTEN CARBIDE—TANTALUM CARBIDE—TITANIUM CARBIDE

FOR CUTTING, DRAWING, SHAPING, EXTRUDING METALS AND NON-METALLICS ★ FOR REDUCING WEAR ON EQUIPMENT OR PRODUCTS YOU USE OR MAKE



shaped pieces are fed into the lower chute. This separator can be furnished in a wide variety of sizes and combinations.

"Hygrade" Lighting Units Designed for General Use

Employing two 40-watt fluorescent lamps, the No. C-101 "Miralume" fluorescent lighting units offered by Hydrade Sylvania Corp., Salem, Mass., is a 100-watt unit designed for general commercial illumination. In this unit the lamps and chassis are housed in a triangular shaped, glass-paneled shade. Over-all dimensions are: length, 49 in.; width, 10 in.; height, 4½ in. Units are available for operation on either 110–125 volts or 220-250 volts, 60 cycle A.C. The fixture comes assembled and wired, complete with lamps.

Westinghouse D.C. Wattmeter Operates from Ammeter Shunt

A direct current wattmeter which operates from a standard 50-millivolt ammeter shunt has been announced by the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa. Construction is similar to that of the usual d.c. shunted ammeter, except that the magnetic field is produced by an electromagnet energized from the line voltage. This magnetic circuit is made from Hipernik, an alloy of iron and nickel. Existing shunts and long, small wire shunt leads as for ammeters may be used for the current circuit of these wattmeters. These instruments are available in the conventional 5½-in. square or 7½-in. round switchboard cases.

Production Counter Uses Plastic Wheels

The Production Instrument Co., 702-06 W. Jackson Blvd., Chicago, Ill. offers the "Silver King" mechanical counter for industrial applications. This counter is the result of four years of development during which each operating function of the counter has been studied. Number wheels now are made from bakelite plastic, reducing by 85 per cent the weight that must be started and stopped with every count. Unbreakable windows of reinforced plastic material are used. Action of this counter is said to be so positive and effortless that a model on test counted at the rate of 60,000 per hour, and on long runs at the rate of 36,000 per hour. Although not designed for these high speeds, they are indicative of the long life claimed at normal speeds.

Packer Composition Applicator Driven by Electric Motor

A compact, self-contained applicator for automatically applying buffing compounds to buffing wheels has been developed by the Packer Machine Co., Meriden, Conn. This applicator operates independent of any external cams, projecting lugs, and is not dependent upon buffing machine speed. It now is standard equipment on all "Packer-Matic" automatic polishing



and buffing machines, and can be attached to all types of buffing machines. Smooth, uniform application of composition is claimed.

The composition holder on this applicator will hold blocks of any size up to 8 in. wide. Length of cake is not limited to the usual commercial sizes. Wheel face and cake can be the same width. The motor unit imparts a smooth, regular rocking motion of the composition cake to the buffing wheel. The unit is driven by a 1/20 hp motorized reduction unit

New Wrinkle Offers "Wrintex" for Facilitating Finishing

The "Wrintex" resin developed by New Wrinkle, Inc., Dayton, Ohio, is claimed to produce a wrinkled texture under any and all conditions. The solution contains 60 per cent resin by weight in 40 per cent Xylol. The high solid content permits a wide range of solvents for after-thinning.

The solution will stand the addition of an equal volume of naphtha, if the naphtha is stirred in gradually. Immediate baking is not necessary. "Wrintex" enamel has been allowed to air-dry overnight and then has been baked. It developed the same texture as a panel placed in the oven shortly after spraying. The finish baked hard. When reduced for free spraying, it will bake hard in one hour at 200 F.

H.-V.W.-M. Insulating Joint Suitable for Steam Lines

An improved hose-type insulating steam joint has been developed by the Hanson-Van Winkle-Munning Co., Matawan, N. J. This joint consists of a special seamless rubber tube, compounded to resist steam and heat, covered with plies of strong, closely woven duck. Between these plies are placed layers of insulating rubber. A heavy gage cover is applied on the outside of the joint. Each joint is 8 in. long and is built to stand 100 lb. steam pressure. It is furnished complete with hose clamp on each end for attaching to standard pipe. The joints are claimed to be fully adequate for all of the normal conditions of acid and other chemical handling equipment in plating rooms.

Cleveland Arch Beams Made for Tramrails

A new series of tramrail arch beams for overhead materials handling systems with loads up to five tons has been announced by the Cleveland Tramrail Div., The Cleveland Crane & Engineering Co., Wickliffe, Ohio. This series consists of three different sizes of arch beam. No. 3000 has a depth of 12 in. and a weight of 28 lb per ft. Having the same depth, Beam No. 3100 weighs 33 lb. per ft. No 3200 has a depth of 15 in. and weighs 50 lb. per ft. This arch beam is a compound section consisting of a wide flanged T-member to which is welded a specially rolled rail. The



vertical member of this T-section is arched at regular intervals, reducing the weight to a minimum without sacrificing strength. The wide top flange adds stiffness and prevents buckling of the beam, even when used for very long spans with heavy loads.

McKenna Metals Announces Tungsten-Titanium Carbide

A new grade of Kennametal tungsten-titanium carbide alloy, which is said to combine unusual hardness with toughness, has been developed by McKenna Metals Co., 103 Lloyd Ave., Latrobe, Pa. Listed as Grade K3H, this alloy is recommended as a tool tip material for light finishing cuts and for fairly heavy continuous cuts on steel of all hardnesses up to 550 Brinell. Tool tips of this material are sup-

plied in three standard shapes, or in special shapes made according to requirements Kennametal K3H has a hardness of 79 0 Rockwell C and a strength of 210,000 lb per sq in on the transverse rupture test

Post Transparent Medium Blue Prints Like Ink

Ink like opacity from hard drawing pencils is claimed for a transparent medium that is not a tracing cloth and not a vellum, offered by the Frederick Post Co, P O Box 803 Chicago, Ill Blue prints made from drawings produced from ordinary hard drawing pencils on this medium have a solid background and sharp white lines On "Blackline" prints the detail is solid and sharp, and the background is uniformly white Standard rolls are 20 yd long and 30 36 42 or 54 in wide It also is available in plain or printed sheets The back or reverse side of this "P T M" is dust protected by the ice glazed finish, similar to the reverse side of tracing cloth The surface is moisture-proof

Kirkland Indicating Lamps Have Small Lens Diameter

A molded plastic unit for use in indicating lamp service has been announced by the H R Kirkland Co Morristown, N J Known as the No T2 unit this device has an extremely small lens diameter which is said to make it suitable for many applications where larger units cannot be used So constructed as to allow a full 180 deg of light over the lens cap even under rays of strong exterior light this unit also incorporates an Anti-false color feature That is the plastic shell and lens-cap are molded in the same color making each unit a matched set In this way danger of inserting a wrong color lens cap into the unit is kept at a minimum Available colors are red green, amber, blue and milky white

Eclipse Extension Gun Sprays Ceilings Easily

The Eclipse Air Brush Co 390 Park Ave Newark N J has placed on the market an improved Type EX extension spray gun for painting large surfaces beyond the natural reach of the operator without the use of scaffolding and staging The extension gun is supplied in lengths up to 12 ft, and the operator can paint an average wall and ceiling without having to climb It is also used for painting large surfaces such as railroad cars and ship hulls This gun has a detachable gun grip control and different lengths of shaft can be used in the same grip The shaft turns in the grip so that the spray can be directed as required The

(advertisement)

Modern Flame Cutting Methods Save Time and Money

Thousands of American manufacturers are saving considerable time trouble and money by taking advantage of the complete flame cutting service offered by the ten Ryerson Steel Service plants

Modern burning equipment manned by specially trained operators and large complete stock of Ryerson Certified Steels make possible speedy and accurate cutting to exact specifications Any shape can be burned from standard O H high carbon or alloy steel plates and billets 1/4 to 15 thick Inside cuts are easily made so there is no limit to the intricacy of shape that may be secured

As cut edges are accurate and clean, little if any machining is necessary Parts can be cut singly or in quantities automatic equipment assuring uniformity on duplicate pieces

Ryerson engineers will be glad to help you on any special problems suggest possible savings and submit estimate of cost Send a blue print or sketch of any application you may have in mind to the Ryerson plant nearest you See advertisement below)

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● You can have a real vacation this year and every year . . . if you follow Ryerson's "Vacation Without a Worry" plan. No need to wonder about interrupted shop schedules! No need to worry about uncertain or delayed steel deliveries!

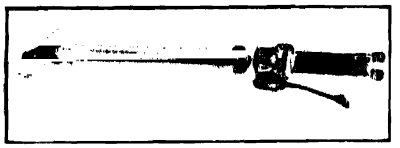
Just leave a memo saying, "Call on Ryerson when steel is wanted." That's all! Because you have complete assurance that all emergency and regular orders will be handled with equal care. Ryerson has thousands of tons of steel—all certified quality—on hand for immediate shipment.

So . . . close you desk! Pack your bags! Have fun, and relax! Ryerson is on the job.

Joseph T. Ryerson & Son, Inc., Chicago, Milwaukee, St. Louis, Buffalo, Cincinnati, Cleveland, Detroit, Boston, Philadelphia, Jersey City.

RYERSO CERTIFIED STEELS

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spray head is supplied in either of the two standard models to insure proper application of all types of materials.

U. S. Pyramidal Base Motor Aligns Motor and Pump

A pyramidal base motor developed by U. S. Electrical Motors, Inc., Dept. 33, 80-34th St., Brooklyn, N. Y., does away with the possibility of misalignment which often develops in connecting a horizontal centrifugal pump to its motor. The mounting is an integral part of the motor. The motor



support on which the pump casting is attached carries the load of the pump, instead of permitting any of the weight to be imposed on the shaft. This design may be used for any machine where perfect alignment is essential, in addition to the driving of centrifugal pumps.

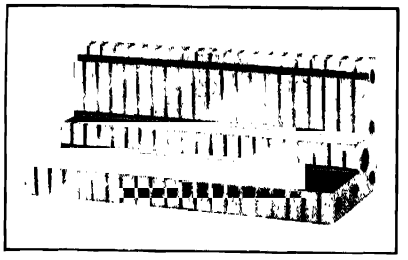
Ward Leonard Midget Relay Has 1 Hp. Capacity

Ward Leonard Electric Co., Mount Vernon, N. Y., has made available a midget relay known as Bulletin 105. Designed for use on either a.c. or d.c., this relay is available with contacts arranged for single pole, normally open, normally closed or double throw.

The relay is rated to handle approximately 1 hp., and is furnished with coils for operation on standard voltages up to 115 volts at standard frequencies. With over-all base dimensions of 2¾ in. x 1⅞ in and an over-all depth of 1½ in., the relay can be mounted in the standard wall-type pushbutton box.

Scherr "Magne-Blox" Angle Holds Parts on Chuck

The "Magne-Blox" angle iron offered by George Scherr Co., 128 Lafayette St., New York, N. Y., is designed for holding work of all types on magnetic chucks. The angle iron consists of a series of steps measuring 3/16, ⅜, ½, 1 5/16 and 1⅝ in. wide upon which may be placed pieces for surface grinding without complicated clamps and attachments. Over-all dimensions of the block are 3x3x7½ in. With the use



of a sine-bar or a bevel protractor, work requiring grinding operations at various angles may be laid out and fastened to the side of the angle iron.

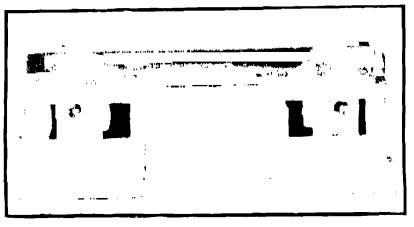
Van Dyke Lighting Unit Designed for Metal Workers

Van Dyke Industries, 2900 Halsted St., Chicago, Ill., offer a No. 5000 adjustable fluorescent lighting unit for factory applications. The arm on this unit has three extension joints which permit the light to be thrown in any direction. Fittings are available for bench, wall or pipe mounting; all of these can be used with the standard arm. The units are available for either a.c. or d.c. operation.

This company also is offering a screw-in socket fluorescent lamp which is suitable for use over production lines and for general illumination wherever fluorescent lighting is desirable. It is supplied for either 15 or 20 watt fluorescent tubes, and is listed as the No. 3001 unit.

Hart Milling Fixtures Save Set-Up Time

Suitable for work on drill presses, shapers, surface grinders or milling machines, these set-up fixtures developed by Hart Machine Co., 26 Mather St., Dorchester, Boston, Mass., have semi-steel bodies and Z-metal clamps. These fixtures are available in



four sizes for ⅜ to 5 in. round stock. T-slot blocks are removable on all fixtures. These blocks measure ⅝ in. on the smaller sizes, and ¾ in. on the large size.

Hunter Sensitized Linen Photoprints from Drawings

A sensitized linen that will reproduce a master positive copy from a pencil drawing for use in every respect like a tracing, has been brought out by Hunter Electro-Copyist, Inc., Syracuse, N. Y. This copy is made by contact photoprinting in ordinary office light, with complete elimination of ink tracing by hand. The trade name given this product is "Heccotex". It is sized and waterproofed to take an office-light emulsion with a non-halation backing. The linen does not shrink or stretch when immersed and therefore makes possible true-to-scale printing of blueprints or other types of drafting room reproductions. The linen is available in 12, 18, 34 and 36-in. rolls, as well as in cut sheets.

Cutler-Hammer Breaker Has Insulated Neutral

Cutler-Hammer, Inc., 205 N. 12th St., Milwaukee, Wis., has announced a change in the case construction used with Type MB Multibreaker assemblies. The device now has an insulated groundable neutral combining the construction of the insulated and the grounded neutral. Simply inserting a screw in a tapped hole of the insulated neutral bar grounds the neutral and the case. These assemblies are available with from 1 to 16 breakers which can be arranged for 2 or 3 hole solid neutral circuits for a.c. service. Units are furnished in flush and surface mounting types.

NEW MATERIALS

"Vicalloy" Alloy Developed By Bell Telephone Laboratories

"Vicalloy" a magnetic alloy of remarkable qualities, was announced to the American Physical Society not long ago by E. A. Nesbitt and G. A. Kelsall of Bell Telephone Laboratories, New York, N. Y. Composed of cobalt, vanadium and iron, the alloy can be made to hold more permanent magnetism than any commercial material. In addition, it can be drawn and rolled--a property not possessed by other permanent magnet materials of importance. For example, it has been rolled into tape 1 500 in. thick and 1/20 in. wide.

Taking its name from the initial letters of its three components, the new material is composed of 6 to 16 per cent vanadium, 30 to 52 per cent iron, and 36 to 62 per cent cobalt. From the molten state it is cast into an ingot, which is hot-swaged to ¼ in. diameter. It then is drawn into wire or rolled into tape as desired. When in final form, it is heat-treated to develop its magnetic qualities. It is permissible to use a heat-treat-

ment that will not be harmful to most high-permeability materials Thus it is possible to weld such pieces to the magnet and heat-treat them both together

TRADE PUBLICATIONS

ABRASIVES Information concerning recent improvements in abrasive snagging wheels for foundry and billet grinding is provided in Bulletin No SA-62, published by Abrasive Co, Philadelphia, Pa

ARC WELDERS Information on the construction and application of transformer type welders is available in a booklet published by the Glenn-Roberts Co, Inc, of Oakland, Calif

BALANCING MACHINES A description of a line of static and dynamic balancing machines for locating and measuring unbalance in rotating parts has been published in booklet form by Gisholt Machine Co, Madison, Wis

BALL BEARINGS Booklet No R-3 issued by New Departure Div General Motors Sales Corp Bristol Conn, is their 1940 edition of Ball Bearing Interchangeability Tables

BEARING ALLOYS Lumen Bearing Co, Buffalo, N Y has published a 70-page supplement to its Engineers' Handbook, containing details of the physical and metallurgical properties of latest non-ferrous bearing alloys

BELT CONVEYORS A 48-page illustrated booklet describing applications of mechanical elevating and conveying equipment has been published by Link-Belt Co, 307 N Michigan Ave, Chicago, Ill

BRAZING A leaflet issued by Charles Hardy Inc, 415 Lexington Ave, New York N Y discusses properties of "Powder-Braze" for low-temperature brazing

BROACHING MACHINES Bulletin Nos 23001 and 24001, published by the Oilgear Co 1302A West Bruce St, Milwaukee, Wis illustrate and discuss the operation of vertical surface broaching machines with automatic shuttle tables

CARBOLOY Engineering Bulletin No GT-120, entitled "Recommendations for Machining Steel" published by the Carboloy Co, 11149 E Eight-Mile Road, Detroit, Mich, provides 12 pages of detailed information concerning proper use of Carboloy-tipped tools in machining steel

CHART A wall chart entitled "Helps for Sheet Metal Men," offered by Niagara Machine & Tool Works, 637-697 Northland Ave, Buffalo, N Y, tabulates circumferences and areas of circles, provides fractional and decimal equivalents of U S gage sheet iron, and includes formulas for estimating metal for duct work

CHUCKING AND TURNING Bulletin Nos 108, 110 and 111, offered by Potter & Johnston Machine Co Pawtucket, R I describe and illustrate the features of automatic chucking and turning machines

CLAD STEEL Jessop Steel Co, 595 Green St Washington Pa has issued a 24-page booklet containing considerable information and specifications concerning 'Silver-Ply" stainless clad steel

CLEANING A leaflet offered by Wayne Chemical Products Co, Detroit Mich discusses methods of cleaning paint spray booths

COUNTERBORES Catalog No 35R, offered by Eclipse Counterbore Co, 7410 34 St Aubin Ave Detroit Mich includes prices and sizes of counterbore tools

COUPLINGS Catalog No 443 issued by Farrel-Birmingham Co 344 Vulcan St Buffalo N Y, contains 44 pages of design and engineering data concerning a line of "Gearflex" couplings

CRANES An illustrated booklet which describes cranes to be used in foundries, machine shops, railroad shops etc is offered by Whiting Corp Harvey, Ill

CUTTERS & GRINDERS Pamphlet No 1317-B issued by George Gorton Machine Co, Racine Wis notes prices and illustrates an increased volume of small tools and accessories

CUTTING SPEEDS Conversion tables showing r p m required for turning bar stock at surface speeds of 90-550 ft per min with "Kennametal carbide tools have been made available by McKenna Metals Co, 103 Lloyd Ave Latrobe, Pa

DIE HARDENING A six-page illustrated folder No S-8541 circulated from Dept 8-N-48 Westinghouse Electric & Mfg Co East Pittsburgh Pa gives descriptive details of a die hardening electric furnace

DIE-MAKING Grob Brothers, Grafton, Wis, has issued a two-page leaflet which illustrates and describes a new die-making machine

DIES AND VISES A 26-page folder circulated by the Producto Machine Co, Bridgeport, Conn illustrates new stocks of die sets, accessories and machine vises

DRILLING AND TAPPING—Edlund Machinery Co, Cortland, N Y, has



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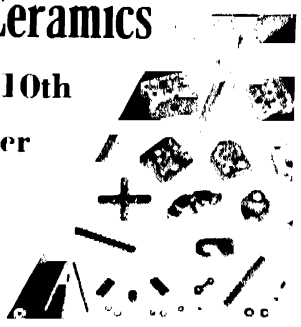
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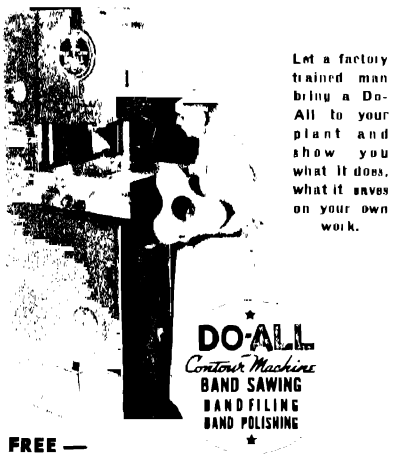


Photograph shows ceramic parts, some as small as 1/16" sent us by Sutpakoff Laboratories of Pittsburgh. They write: "We are pleased to mail you ceramic samples. Note these are miniature parts. Dies are made of Mangana Steel and our DoAll 'walks right through' the most complex design in from 1/4 to 1/10 the usual time. The DoAll is one of our most versatile and time saving machines."

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issued two illustrated bulletins concerning a line of drilling and tapping machines. No. 103 contains 8 pages covering the Nos. 4B and 1A machines, while No. 101 provides 8 pages of information concerning the Nos 2B and 3B models.

DRILLS Whitman & Barnes, 2108 W. Fourth St., Detroit, Mich., has issued a 4-page leaflet entitled "The Right Drill for Every Job," which describes six types of drills for various materials.

FILES Nicholson File Co., Providence, R. I., has issued a four-page pamphlet describing a file to be used on stainless steel and other alloy steels.

FILING TOOLS A four-page circular No. D-357 which describes filing machines has been published by Continental Machines, Inc., 1301 Washington Ave South, Minneapolis, Minn.

FLEXIBLE COUPLINGS A 12-page pamphlet issued by Charles Bond Co., 617-623 Arch St., Philadelphia, Pa., provides specifications of several types of flexible couplings.

GAGE BLOCKS A leaflet issued by Johansson Div., Ford Motor Co., Dearborn, Mich., provides prices of chrome-plated Johansson gage blocks.

GEAR ACCURACY A four-page folder, circulated by National Broach & Machine Co., Detroit, Mich., explains the operation of gear checking equipment.

GEAR HOBBERS Bulletin No. 218, circulated by Gould & Eberhardt, Newark, N. J. describes a new line of universal manufacturing type gear hobbing machines.

GEARS A 7-page folder circulated by Cross Gear & Machine Co., 3250 Bellevue Ave., Detroit, Mich., illustrates the features of a gear tooth burring machine.

GEARS A 52-page booklet containing a number of articles on factors affecting gear production has just been released by Michigan Tool Co., 7171 E. McNichols Rd., Detroit, Mich.

GEARS Catalog No. 39, published by Illinois Gear & Machine Co., 2108 N. Natchez Ave., Chicago, Ill., includes prices and engineering data on many types of cut gears.

GRINDERS Brown & Sharpe Mfg. Co., Providence, R. I., has issued a 20-page booklet which describes and illustrates a wide variety of grinding machines.

GRINDING 24 pages of information and data concerning internal grinding equipment are provided in Form No. 30, issued by Bryant Chucking Grinder Co., Springfield, Vt. Specifications of the Nos. 16-16, 16-A, 16-28, and 16-38 grinders are included.

GRINDING AND BORING MACHINES "Precision Grinding & Boring Machines," a 106-page booklet offered by the Heald Machine Co., Worcester, Mass., describes and illustrates a complete line of internal and surface grinding machines.

GRINDING WHEELS The Norton Co., Worcester, Mass., has issued a three-page pamphlet showing instances which indicate the value of consulting engineering service to reduce grinding costs.

HAMMERS Bulletin No. 1275 published by Chambersburg Engineering Co., Chambersburg, Pa., describes the working of a new type pneumatic forging hammer.

HOB SHARPENERS A machine used for sharpening straight and helical shaped hobs and form cutters is described in Pamphlet No. 4, issued by Barber-Colman Co., Rockford, Ill.

HOISTS Catalog No. G-1 circulated by Coffing Hoist Co., Danville, Ill. illustrates the operating and construction features of hoists.

JIG GRINDER Marburg Bros. Inc., 90 West St., New York, N Y. describes the operation of a precision jig grinder in a four-page folder.

LANDIS "The Story of Landis Tool Company," a 16-page illustrated booklet issued by Landis Tool Co., Waynesboro, Pa., discusses the company's history, progress and personnel.

LATHE OPERATION The Atlas Press Co., 1822 N. Pitcher St., Kalamazoo, Mich. has published a manual of lathe operation to provide authentic information for owners of lathes and other types of metal cutting machines.

LATHES The R. K. LeBlond Machine Tool Co., Cincinnati, Ohio features the construction of a lightweight lathe in a 48-page booklet.

LATHES Three booklets issued by the Sidney Machine Tool Co., Sidney, Ohio, describe construction and operation features of toolroom lathes.

LATHES Catalog No. 50, published by South Bend Lathe Works, 226 E. Madison St., South Bend, Ind., contains 48 pages of information concerning the 9-in. "Workshop" precision lathes.

LEATHER BELTING A 24-page booklet offered by the Chicago Belting Co., 113-125 N. Green St., Chicago, Ill., discusses the economic operation of leather belting in power transmission.

LEATHER BELTING Two folders circulated by J. E. Rhoads & Son, 35 N. Sixth St., Philadelphia, Pa., sum up the advantages of Tannate flat leather belting for power transmission.

METAL SAWING Bulletin No 50, published by the Peerless Machine Co., Racine, Wis illustrates the construction of a hydraulically operated metal sawing machine.

MILLERS New dial type milling machines, available in plain, universal and vertical types are fully described in a 28-page catalog, No M-868, published by Cincinnati Milling Machine Co., Cincinnati, Ohio

MILLING ATTACHMENTS Design, engineering and operating features of "All Angle" milling attachments, are provided in an eight-page illustrated bulletin offered by Fray Machine Tool Co., 515 W. Windsor Road, Glendale, Calif.

MILLING MACHINES The operation of high speed vertical milling machines is featured in a four-page folder published by Blank & Buxton Machinery Co., 620 N Mechanic St Jackson, Mich

MOTORS Details of General-purpose universal motors made flat to occupy minimum space are provided in leaflet F-8494, available from Dept 7-N-20, Westinghouse Electric & Mfg Co., East Pittsburgh, Pa

MOTORS An 8-page illustrated folder No GEA-2915A issued by the General Electric Co., Schenectady, N Y., features the design and application of a new capacitor-motor

OVENS Catalog No 107, published by the Gehnrich Corp., Skillman Ave and 35th St., Long Island City, N Y., describes the operation and design of ovens and dryers for industrial heating processes

PILLOW BLOCKS Bulletin No A-325 issued by Dodge Mfg Corp., Mishawaka, Ind., contains information covering their Dodge-Timken double interlock pillow block and selection tables

PIPE TOOLS A 24-page booklet issued by Beaver Pipe Tools, Inc., 1940 Dana Ave., Warren Ohio describes construction and lists prices and sizes of pipe tools

PLUG GAGES "Pilot" cylindrical plug gages, a new product, are described in an illustrated 4-page bulletin offered by Pratt & Whitney, Div Niles-Bement-Pond Co., West Hartford, Conn.

PORTABLE TOOLS Black & Decker provides complete specifications of an extensive line of portable electric tools in its 64-page illustrated 1940 catalog

PRESSES Operating features of double crank presses are outlined in Bulletin No. 64-F published by Niagara Machine & Tool Works, 637-697 Northland Ave, Buffalo, N. Y.

REAMERS Specifications of "Go & Go" hogging reamers are included in a 4-page illustrated folder, No 108, offered by Goddard & Goddard Co., Detroit, Mich

ROTARY MACHINE Bulletin No 75-A issued by Niagara Machine & Tool Works 637 697 Northland Ave Buffalo N Y includes illustrations of a complete line of machines for performing the varied operations in sheet metal shops and production requirements in the manufacture of metal products

SCREW DRIVERS Booklet No 135, circulated by Stanley Tools, New Britain, Conn presents an illustrated description of a wide variety of screw drivers for industrial use

SCREW-MACHINE TOOLS Brown & Sharpe Mfg Co., Providence, R I., has published an 84-page illustrated loose-leaf catalog providing specifications and operating recommendations for an extensive line of screw-machine tools

SCREWS The Bristol Co., Waterbury Conn notes prices and sizes of screws with the multiple-spline design in Bulletin No 840

SHELL FORGING Baldwin-Omes shell forging presses, which are made in three sizes for shells from 40 to 180 mm., are described in Bulletin No 110 offered by Baldwin Southwark Div., The Baldwin Locomotive Works, Philadelphia, Pa These presses are manufactured under exclusive license from Omes-Continental, Holland and readily can be converted to standard universal forging machines

SHELL MACHINES Bulletins published by The Prescott Co., Menominee, Mich., describe the Nos 21 and 23 "Amalgamated" shell turning machines designed by Lucien I Yeomans The No 21 machine will swing 13 in over the former carriage and has a carriage travel of 39 in The No 23 machine swings 27½ in over the ways and has a 44 in. carriage travel

SOLDERING IRON Hexacon Electric Co., 161 W Clay Ave., Roselle Park, N J., has just published catalog No 100 which illustrates and describes a complete line of electric soldering irons

STEEL EQUIPMENT To describe a complete line of steel fabricating equipment Bulletins Nos. 49 and 50 have been published by Hannifin Mfg Co., 621-631 So Kolmar Ave., Chicago, Ill

STEEL HARDENABILITY Bulletin Series No. 320 published by the University of Illinois Engineering Experiment Station, Urbana, Ill., and sold for 70 cents, contains information on the hardenability of carburizing steels

STEEL PRODUCTS The 1940 Scully stock list and reference book containing 254 pages of information essential to users of steel products has been published by the Scully Steel Products Co., 2364 So Ashland Ave., Chicago, Ill

THREAD CUTTING Landis Machine Co., Inc., Waynesboro, Pa offers a bulletin which describes the application of thread cutting die heads thread cutting machines, and collapsible taps

THREADING A folder now being distributed by Landis Machine Co., Waynesboro, Pa., illustrates many machines in the Landis line.

TURRET LATHES Jones and Lamson Machine Co Springfield, Vt provides a catalog which includes dimensional diagrams, photographs, and general descriptions of turret lathe tools

V-BELTS B F Goodrich Co., Akron, Ohio, describes fractional-horsepower V-belt designs in a 24-page catalog section No 2180

V-BELTS Catalog Section No. 151, issued by Allis-Chalmers Mfg Co., Milwaukee, Wis., provides engineering information on multiple V-belt drives

WELDED CHAINS The American Chain & Cable Co., Inc., Bridgeport, Conn has published a new edition of Catalog No 365 on welded chains

WELDING Lincoln Electric Co., Cleveland, Ohio, has issued a 6-page illustrated folder, Bulletin No. 427, entitled "How to Build Your Own Engine-Driven Welder"

WELDING Bulletin No GEA-3313, issued by General Electric Co., Schenectady, N Y., provides 8 pages of information concerning the No CR7503-G weld recorder for use with spot-welders

WELDING A guide to the welding of commonly used metals has been printed in Chart No 4464 by Linde Air Products Co., 30 E 42nd St., New York, N Y

WELDING Welder Specification Bulletin No 336, issued by Lincoln Electric Co., Cleveland, Ohio, contains 4 pages illustrating construction and use of the 200-amp "Shield-Arc Junior" engine-driven welder.

WELDING ACCESSORIES A 4-page bulletin, No CE-10 describing weld-

ing helmets and other accessory protective equipment, has been made available by Mine Safety Appliances Co., Braddock, Thomas & Meade Sts., Pittsburgh, Pa.

WELDING CONTROL A four-page folder No. F-8451-A, circulated by Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., describes a method, without movable parts, to control resistance welding.

NEW BOOKS

TRAINING PROCEDURE—*By Frank Cushman, consultant in vocational procedure, Federal Security Agency, U. S. Office of Education. 229 pages. John Wiley & Sons, 440 Fourth Ave., New York. $2.50.*

The growing demand for skilled men in many branches of industry together with the continuance of a high degree of unemployment has suggested to many that the answer may be found in vocational training. Consequently, the book is timely.

Mr. Cushman's volume deals specifically with the training of employed personnel. He does not attempt to minimize the benefits of trade schools or other means of affording broad educational opportunities, but in order to treat more fully one angle of the subject, he limits his topic to improvement in the performance of work.

The author treats his subject logically. He starts with the planning and organization of training classes. He discusses the putting-over stage, during which the plans are translated into action. He outlines the means of appraising the results of a training program, and in realizing these results into manufacturing improvements. Lastly, he describes the need of maintaining the gains thus achieved. Too many programs, for one reason or another, tend to slump. This danger can only be avoided by stimulating a continuity of interest.

Mr. Cushman's work is designed not only for those in immediate charge of training programs, but for executives responsible for company policies upon which such activities depend.

•

TURRET LATHE OPERATOR'S MANUAL—*By W. K. Bailey and J. R. Longstreet. 240 pages. Published by The Operators' Service Bureau of the Warner & Swasey Co., Cleveland, Ohio. $2.50.*

Written especially to help the operator of a turret lathe to do a better job with less effort, this book outlines methods, short cuts and suggestions which were compiled by men who have spent a large part of their lives with turret lathes. It has been written expressly for the man in the shop, is easy to read and easy to understand. There are more than 360 illustrations, including many detailed drawings. Incorporated as an appendix is a data section giving recommended speeds and feeds for turret lathes, tool angles for both high speed steel cutters and carbide cutters, as well as much information on standard thread sizes.

The addition of a turret to the metal turning lathes some 90 years ago made it possible to machine identical parts without constantly changing cutters. Since that time many improvements have been made in the basic design of turret lathes, as well as in tools and tool holders available for use on both job-lot and mass production work. Of particular interest in this book is a discussion, in the latter chapters, of permanent tooling set-ups for bar work and for chucking work. These set-ups are arranged so that the large and heavy tools are permanently mounted in their logical order on the machine. If necessary, for certain jobs, the tool stations can be back-indexed, or skip-indexed, to suit the requirements of the job, but the flanged tools themselves are not changed from one turret face to another. Ordinarily, the extra machine-handling time required to skip-index is less than the time that would be required to remove these tools from the machine, or to change their position on the turret. The lighter tools in the universal set can be arranged in various combinations to adapt the tools in the permanent set-up to each particular job as it comes along.

•

DICTIONARY OF METALS & THEIR ALLOYS—*Edited by F. J. Camm, editor Practical Engineering. 245 pages. Distributed by The Chemical Publishing Co., 148 Lafayette St., New York, N. Y. $3.*

Cross-indexed for ready reference, this dictionary of metals and their alloys contains descriptions of the metals, their compositions and characteristics. The book includes information about practically every known metal, and almost every type of commercial metallic alloy. Where necessary, historical facts have been included in the text. The dictionary is supplemented with special sections on plating, polishing, hardening and tempering, metal-spraying, rust-proofing, chemical coloring and useful tables.

Written in England, this dictionary contains references to many European alloys not in common use in the United States. Where the spelling of the name of a metal is different in the United States and in England, both spellings are shown.

This book should be especially valuable to those engineers, production supervisors and purchasing agents who must be familiar with all metals and their alloys, particularly when references sometimes must be made to European designations.

OXY-ACETYLENE WELDING FOR BEGINNERS—*By J. W. Giachino. The Manual Arts Press, Peoria, Ill. 96 pages. $1.48.*

As indicated by the title, this book is distinctly for the beginning student of welding. The series of 23 lessons represents the scope of work which must be mastered before one can become an expert welder. Each is accompanied by brief explanations of needed apparatus, safeguards, use of tools and methods of procedure, followed by questions which clinch the information presented in the given lesson. Lessons are arranged to be carried out in the order presented. In addition to the lessons, the book contains seventeen projects to give the student an opportunity to apply his knowledge of welding to a practical purpose. An abundance of clear illustrations aids greatly in presenting the information.

TO THE EDITOR

Not All Youth's Fault

Dear Sir:

Your interesting editorial "On High-Nosing the Dirty Worker" is worthy of comment. To all of us who have served our time in the shop, the term "mill worker" is preferable, as cleanliness is a most important attribute in things mechanical. To me, nothing smells cleaner than a well-kept shop under full production. To the mill worker who is interested in his job, it is just like the smell of the sawdust ring to the circus lover . . .

Speaking of high-nosing the mill worker, I do not believe that youth is altogether at fault. What we need is to establish greater confidence in business through the general public; to invest more capital; to utilize invention and discovery to invigorate business and thereby create more jobs so that the young fellow of today can have an opportunity to serve his time in the shop with the older, more experienced workman. The youth has something the older workman needs, and so with the older worker. Through this medium, better employee relationships can be set up by promoting loyalty to one another as well as to the employer.

There are many fathers who hope their sons will have a better chance than they had. Let's give the youth of today that better chance. This is the way we can help create the great men you mention and many more Edisons and Ketterings. Genius is only great patience, but will die without opportunity.

Sincerely yours,
H. M. BRIGHTMAN
Assistant to President
Columbia Steel & Shafting Company
Pittsburgh, Pa.

AMERICAN MACHINIST

August 7, 1940



Photo courtesy Westinghouse

Getting Closer *Watt's "thickness of an old shilling" has been reduced to a ten thousandth of an inch in modern shops*

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N H STOVELL, *Superintendent*
Stanley Works of Canada, Ltd
Hamilton, Ontario

"I always check advertising and new-equipment pages in *American Machinist* first."



WHAT'S IN THIS ISSUE

MEASURE FOR SUCCESS

Every so often we, like you, get embroiled in conversation with some one who insists on asking if a one-inch plug will go in a one-inch hole. You know how such conversations run. Eventually you get around to explaining about allowances and tolerances, and perhaps you pin your opponent down to admitting he doesn't really know what he means when he specifies a one-inch plug or hole. Once you get him on the defensive you're almost sure to go on about the science of measurement, about its limitations, both theoretical and practical, about latest developments in the art.

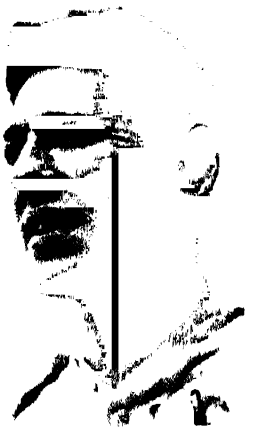
For it is an art. Down through the centuries man has perfected it, until now we can measure—accurately—almost anything under the sun. So universal is the practice of measurement that the fundamentals have nearly been forgotten by most of us. To our mind there's nothing better than a review of basic principles as preparation for the more advanced. Thus we respectfully recommend C. C. Street's article beginning on page 565, which discusses some elementary and not-so-elementary aspects of direct and comparison measurements. It's the first in a series on measurement for production—a series which will include five articles in all. Mr. Street is chief engineer of Federal Products Corporation, so knows the ins and outs of measurement for production—or vice versa—about as well as anyone.



C. C. Street, left, proves his point to John Warthen, Federal Products chief designer. Eventual outcome: greater accuracy.

SLICK

Now that production is again humming, the problem of proper machine tool lubrication once more rears its head. Wright Aeronautical, which has managed to lick most of the production problems you could name, has come up with a solution to this one too. Like most other really good systems, the method Wright uses boasts simplicity and effectiveness. And also like other good ideas, it can readily be applied in any plant, large or small. On page 568 H. E. Linsley tells about it.



H. E. LINSLEY

JIG TIME

The more sub-assemblies you split a plane into, the more jigs you can use. The more jigs you use, the more men you can employ. And the more men you employ, the more planes you can make in a given time. Such is the philosophy of Republic Aviation, which is faced with the same problem as everyone else in the aircraft industry. Even automobile men have expressed approval of the method—which is really something. How it's worked out in detail is revealed on page 570 by Hans Lasker, Republic's chief tool engineer.

VERSATILE

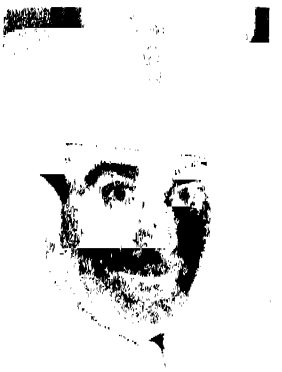
What do *you* think of when adhesive tape is mentioned? So do we—or at least we did, until E. J. Tangerman made us realize its many uses in industry. The fact that our attention had to be called to it made us wonder whether, if we reminded our readers of it, they might not hit on a few more ways it could save money for them. Hence the story on page 582.

ANONYMOUS!

Now and then we get letters from readers who take violent exception to what we say. Some are from our best friends, some from our severest critics. The best we've had in a long time you'll find on page 577. For obvious reasons the writer prefers to remain anonymous.

ALL WELDED

It isn't often that welding is used exclusively in the assembly of a major unit. But such is the case at the Fort Wayne works of International Harvester, where welding is the only fabrication method used in assembling truck cabs. Both stationary and moving jigs and fixtures help the welders, and an ingenious overhead tramrail system keeps the floor from getting too cluttered up. On page 579 William A. Salzmann describes them.



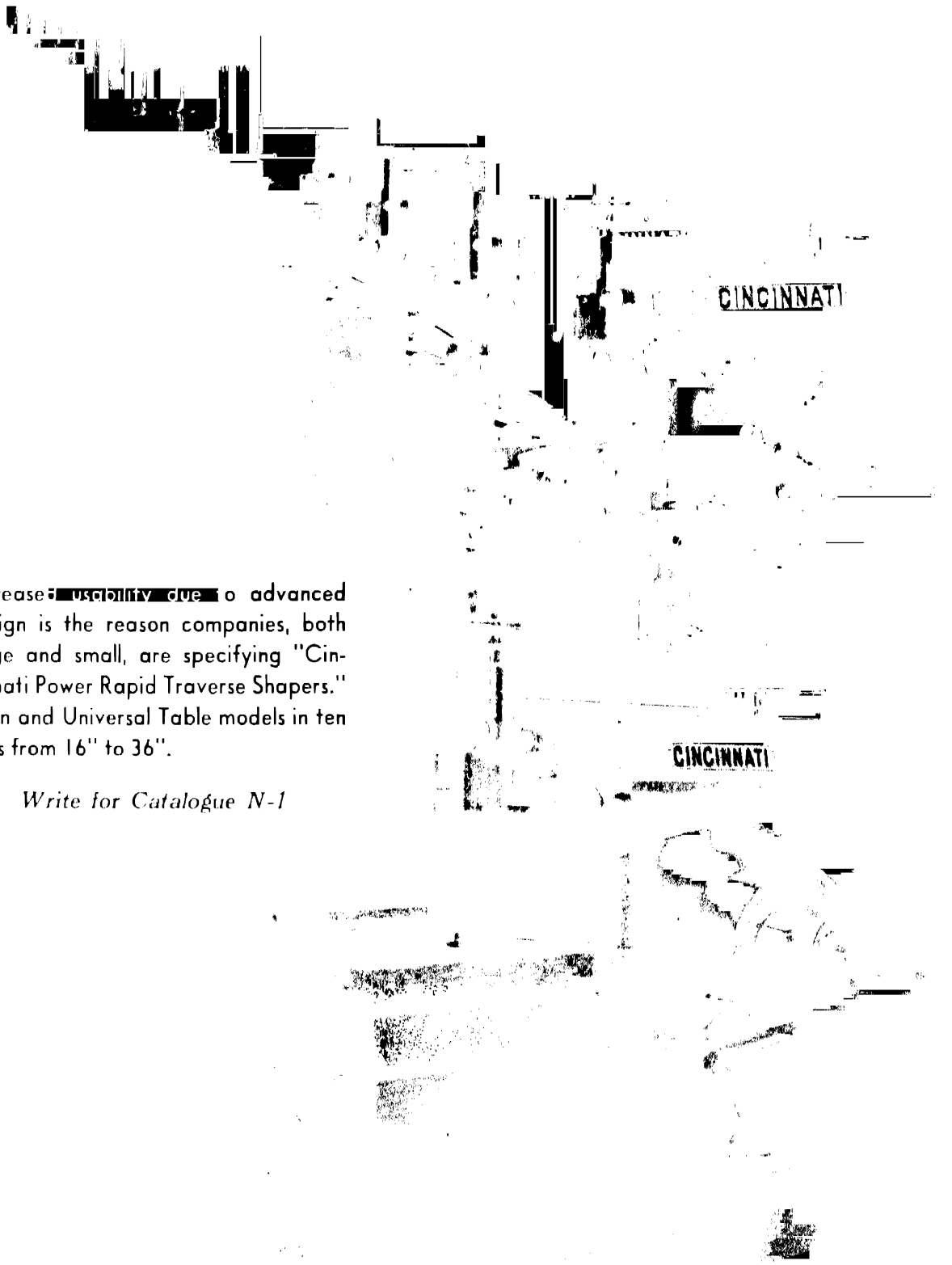
WILLIAM A. SALZMANN

BACK TO BRONZE

Time was when bronze was used for a lot of things. Still is, in fact, but you'd hardly expect to find die parts made of it. But for embossing thin steel they're satisfactory—and cheap. If you have a model of the part, making them is simple. Mark Golden tells the story on page 574.

COMING

Scheduled for the next issue is another of our extra dividends. These dividends (which, we're happy to announce, will continue to be paid pretty regularly) are in the form of special sections on the working of various materials. Apropos of the aircraft industry in particular, this next one is devoted to the working of aluminum alloys. It will be the biggest such section we've yet published—sixteen pages jammed with data. Look for it in AMERICAN MACHINIST.



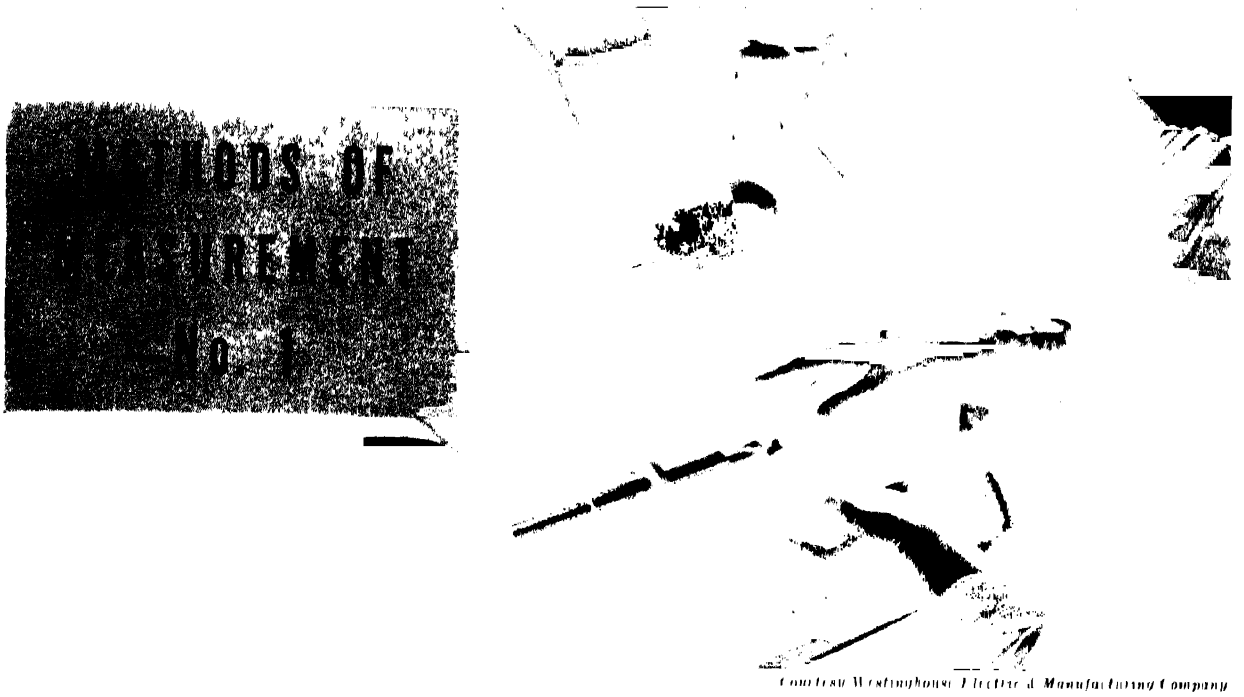
ncreased usability due to advanced esign is the reason companies, both rge and small, are specifying "Cin-innati Power Rapid Traverse Shapers." lain and Universal Table models in ten izes from 16" to 36".

Write for Catalogue N-1

Photo above. A single shi ment to a dom estic custom

THE CINCINNATI SHAPER COMPANY CINCINNATI, OHIO

ESTABLISHED 1877 **AMERICAN MACHINIST** BURNHAM FINNEY, Editor



Courtesy Westinghouse Electric & Manufacturing Company

Direct and comparison measurements

BY C C STREET CHIEF ENGINEER FEDERAL PRODUCTS CORPORATION

Precision manufacture of metal parts now calls for tolerances thought impracticable a few years ago. Measurement by comparison makes it easier

CONTINUED DEVELOPMENTS in the art of interchangeable manufacture on a production basis has brought to the fore a need for rapid, precise checking of the dimensions and other factors that control the smooth working of individual parts. There was a time in industry when much faith was placed in the use of fixed gages, of which the plug and ring are examples. The rapid wear experienced with this type of gage represented a large investment to the manufacturer and was the cause of a major maintenance problem.

With the improvement in the art of comparison measurement these fixed gages became standards that were used only periodically. For that reason, changes in dimensions of these gages because of wear have been greatly reduced. With this change in method of measurement, a manufacturer could afford to produce fixed masters to a higher degree of accuracy than when they were made for quantity inspection. By the use of precise comparison instruments, the dimensions of these masters then could be transferred accurately to the piece being checked with a resultant increase in accuracy of the finished product.

For most purposes, size blocks of the Johansson or Hoke type are suitable as masters. Practically every machinist and toolmaker today is familiar with these important aids to production maintained by modern manufacturing plants. It is sufficient to say that a good quality size block is as satisfactory as a master gage for the most precise type of measurement that ordinarily would be met with in a manufacturing plant. Only in laboratories that specialize in extremely precise measurements is accuracy greater than that given by these blocks required.

Comparison measurement perhaps can be most clearly explained by an example. Suppose we have two bars of which the length of one is known, and it may be assumed for this explanation that this known length is an exact value, and the second bar differs in length by only a small amount from the first. If we can determine to a high degree of precision what this small difference is, we will then know the exact length of the second bar. The determination of the magnitude of this slight incremental length is the art of comparison measurement. The instrument does not tell us the length of the second bar,

nor measure the length of the first bar, it merely indicates the difference in length between them.

A micrometer caliper is a good example of a direct measuring instrument. When using direct measurement, the device tells us the size of the part measured independent of any other master or standard. The same is true of the pocket scale, the vernier caliper and many other such instruments. The distinction between these devices and a comparison instrument lies in the fact that they carry with them a standard of reference.

In the true sense of the word, even a micrometer caliper is a comparison instrument, since it compares the size of the work being checked with the amount the spindle advances along the helix of a screw thread. In using this instrument we are, in reality, comparing the work with the screw thread. The instrument still remains in the direct measuring class since it does contain a standard of length, which in this instance is the screw thread. The vernier caliper is of the same classification, for here the standard of length is the graduated scale on the column.

With the micrometer, the correct contact with the work is determined by the pressure exerted when turning the spindle, and with the vernier caliper when placing the movable jaw against the work. It has been shown on many occasions that no two workmen exert the same force on these moving parts, and that any one workman will not consistently exert the same force when making measurements. The accompanying tabulation shows this variation clearly for five measurements taken on the same piece by each of five operators. It will be noted that the errors between the readings obtained by different workmen are greater than the variations between the readings obtained by a single man taking repeated readings.

For extremely precise work there are sufficient errors in the individual readings of each man to make questionable the exact value of any single reading. Skill of a high order has been achieved by the manufacturers, and in most instances the accuracy built into the instrument is far greater than the average workman can use. In



Comparison measurements are quickly made in special or general-purpose instruments set to size with master gages, or blocks of the Johansson or Hoke type

the micrometer caliper, the addition of a ratchet stop (seldom used by most workmen) provides a means for controlling the measuring pressure with a fair degree of accuracy.

Fixed masters, such as plug and ring gages, can be considered as direct measuring devices. As such they possess inherent limitations when they are used directly on the work to be measured. In the first place, when using a plug gage to check a bored hole, there may be a tendency to force the plug slightly into the hole, particularly when the hole is bell-mouthed. This produces a border line of uncertainty as to whether the part should be accepted or rejected, since the amount of pressure necessary to enter the plug is to some extent a measure of the size of the hole. In thin-walled rings, a substantial amount of expansion of the piece may be produced in this manner.

Direct measuring devices, as a rule, are incremental. An example is the pocket scale where the finest graduations usually are either $\frac{1}{64}$ in. or 1/100 in., so that when using such a device we can measure directly to an accuracy of the least division on the scale, but must estimate any fraction of this division that is needed. The same applies to plug and ring gages where a certain size hole, to be properly checked, will have a go and not-go gage. We may inspect the part with both gages and find that it comes within the specified limits, but we have no knowledge of where within those limits it lies. For some types of work, this is of no consequence.

An example might be the wrist pin used in automobile pistons. Let us assume that the nominal size of this wrist pin is 1.250 in. It may be that the manufacturer wishes to hold his maximum working tolerance to ±0.0001 in. He is thus faced with the problem of allowing +0 and −0.00005 in. on the wrist pin and −0 and +0.00005 in. on the bored hole of the piston. This then would give him a maximum looseness of 0.0001 in. and, theoretically, a minimum of 0 clearance. Such a procedure as this is rather expensive.

Let us assume that this manufacturer assigns size groups to the wrist pin of −0 to +0.00005 in. for the first group; +0.00005 to +0.0001 in. for the second group; and so on. To determine in which group the wrist pin or bored hole would fall calls for many successive inspections with an elaborate set of plug and ring gages. Such inspection would, of course, be expensive. By comparison methods, using an indicating device, the gage need simply be set to the nominal value and have its dial marked into the proper groups. The operator then has no other task than to place the parts in the gage to determine in which group they fall, and then place them in a pan.

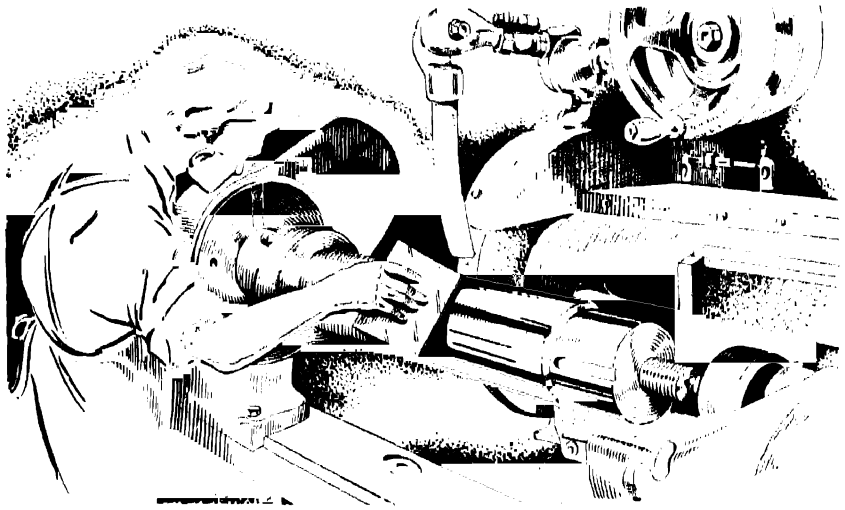
In general toolroom work direct measurement is usually used in preference to the comparison method. This is caused by several reasons, the most outstanding of which is the familiarity of the average toolmaker or machinist with micrometer calipers and allied instruments that have been his standbys for years. Many workmen have achieved great skill in the use of these devices. Toolroom conditions of today are much like those existing among some of the skilled mechanics at the beginning of the century. With the use of nothing more than a caliper, the old-time machinist could fit a shaft to its bearing with a clearance of only a few thousandths of an inch. The distinction between work of that type and what is now demanded by industry is that the artisan of a past day worked to a thousandth of an inch, but he did not know what thousandth.

The second article in this series by Mr. Street will appear soon.

COMPARISON OF MICROMETER MEASUREMENTS

(All measurements taken on same piece five times by each operator)

Measurement No.	1	2	3	4	5
Joslin	0.47800	0.47790	0.47800	0.47800	0.47800
Blunquist	0.47790	0.47790	0.47795	0.47790	0.47797
White	0.47795	0.47805	0.47805	0.47807	0.47803
Dutchey	0.47800	0.47798	0.47800	0.47790	0.47795
Thomas	0.47805	0.47805	0.47802	0.47800	0.47802



A backward and forward movement of a copper gage across a ground surface, parallel with the axis of the piece, shows up grooves remaining in the surface

Simple rules for better grinds

BY H. C. URBAUER, ELECTRO-MOTIVE CORPORATION

Superior commercial finishes can be produced economically in standard grinders when five basic rules are observed by painstaking skilled operators

WHEN IS a bearing surface smooth enough? Is a bearing surface ever good enough; or, just what do we mean by good enough? These are questions that arise every day in plants making machinery; and they represented a major problem to us before we arrived at a satisfactory solution.

The production of high quality ground bearings brings about serious problems for the engineer whose business it is to keep down production costs. If the grinder operator has not learned how to make a good bearing surface, the necessity of polishing or lapping operation is expensive.

If the following five points are observed, and followed carefully with painstaking efforts, any good grinder operator can produce super-finished surfaces on soft steel, as well as on case-hardened material. The grit and the grade of the wheel are only incidental, I may add, since I see operators every day produce a better finish with even a No. 46 grit wheel than others do with wheels several grades finer. It is necessary that the following points be observed:

1. First of all it is essential to know that the wheel is in absolute balance and that there is no vibration.

2. We must know that the machine bearings are tight and, at the same time, free enough to permit the machine to operate without heating.

3. Use the thinnest lubricating oil adaptable to the machine and its condition that will maintain a cool running bearing, even though you may use kerosene.

4. Be sure to keep the cutting surface of the wheel clean and free from steel particles that may have embedded themselves during the roughing operation.

5. You will not be able to secure best results unless provisions are made for filtering or otherwise removing particles of grit from the cooling solution so that none will be thrown between the wheel and the work on the last or polishing pass.

I do not wish to infer that by observing these rules one may produce bearing surfaces in competition with specialized super-finishing machines, but I do claim that it is possible to produce a commercial finish that compares favorably for all excepting special purposes. It certainly is possible to produce a finish that is far superior to those usually found.

But how are we to know when our bearing surfaces are smooth enough so that there is nothing left that can reach through the oil film to dig into the soft bearing wall. What can we furnish as a positive gage or standard of measurement by which we may isolate the fitness of a ground bearing surface?

These questions were put to us when we demanded a better finish. At that time we had nothing to offer that was practical. We worked for months in search for data that might be of help to us. Just before we gave up we stumbled over a method that now is so simple that it seems ridiculous.

Just a simple piece of copper used as a gage has solved these problems. This gage is scraped with a forward and backward movement across the ground surface, parallel to the axis of the piece, when all traces of oil have been removed and the piece is dry. We try to force the corner or edge of the gage into the steel, whether it is soft or case-hardened. If this operation does not leave copper dust on the shaft, or does not produce frayed or worn edges on the gage, we know we have a spindle bearing that is smooth enough to be used anywhere. We have eliminated friction in direct proportion to the disappearance of copper dust during the test.

At first we did not think very highly of this test method. By constant application we have learned to appreciate its value and have learned how to produce bearings previously considered impossible.

Oil well

BY H. E. LINSLEY, WRIGHT AERONAUTICAL CORPORATION

Properly controlled lubrication of all machine tools and other plant production equipment will result in reduced maintenance and greater output

THE PROBLEM of proper lubrication of machine tools assumes considerable importance in any plant engaged in large scale operations. This is particularly true if the production equipment is to be maintained at maximum efficiency for the normal life of the equipment. The highly skilled machinist may be expected to give his machine the care and attention it deserves; but the average shift worker, interested only in maintaining the maximum output, usually is content to let the machine run until it breaks down.

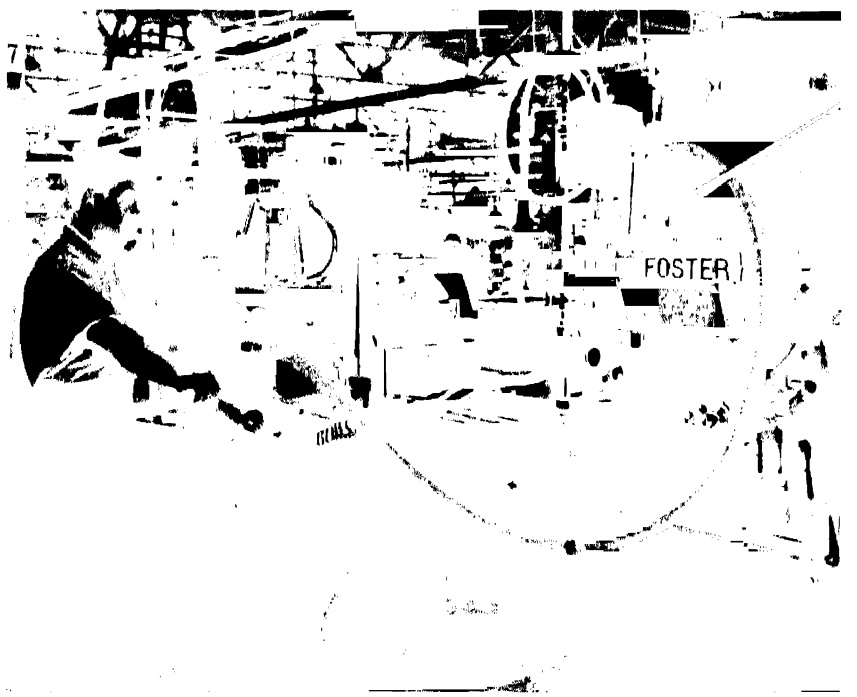
When the plant is running three shifts, this condition is aggravated by the tendency of each operator to leave the oiling job to the man on the next shift. The natural result is that nobody oils the machine, despite the fact that when running 24 hours a day lubrication is of paramount importance. The bearings never have a chance to cool off and recover from fatigue.

From the point of view of management such a system is intolerable, and in many cases the responsibility for proper lubrication is placed directly upon the shoulders of the foremen. Much can be accomplished in this way, but confusion inevitably results when each foreman has his own ideas as to what constitutes proper lubrication, and may accept or reject the machine maker's recommendations at his own discretion. It too frequently happens that some two or three general purpose oils are expected to fulfill all the requirements of the shop without regard for the widely differing functions which they are called upon to perform.

Under the constant demands for greater production, necessitating higher speeds and heavier cuts, machine tools have been growing steadily heavier. They can continue to function with their original accuracy only if the application of the proper lubricants permits smooth running of the actuating and generating mechanisms. Machine tool builders are turning more and more to automatic lubrication, with the idea of eliminating as far as possible the always fallible human element.

This brings up the question of what oils to use and what are the most suitable viscosities for lathe headstocks, high speed grinders, gear hobbers, speed reducers, hydraulic systems, and similar applications. Viscosity is not the only consideration. If the machines are to continue to operate twenty-four hours a day without breakdown, the oils in the automatic systems must be very stable.

Only when a lubricant can fulfill these requirements will the oiling systems and hydraulic mechanism continue to be dependable and automatic. Nor can the selection of suitable oils be left to the average purchasing department, since this cannot be made on the basis of price alone, nor yet on the "clear amber color" frequently regarded as a criterion by the uninitiated. A proper understanding of machine tools, and a thorough knowledge of the properties of different oils, is essential if the most economical and most reliable system of lubrication is to be worked out.



Each oiler has a special two-compartment truck with pumps for clean and dirty oil. He is responsible for all lubrication except the daily hand oiling done by the machine operator

Survey of Requirements

This problem has been solved in the plant of the Wright Aeronautical Corporation by working in collaboration with the engineers of one of the major oil companies. A survey was made of every machine in the shop, and charts were prepared showing the lubrication requirements of the machine, and the method by which the lubricant was to be applied, whether by hand, forced feed or drip feed.

Opposite each item was then listed the lubricant recommended by the machine builder, when obtainable, and also that recommended by the oil company. After these charts were completed they were examined with

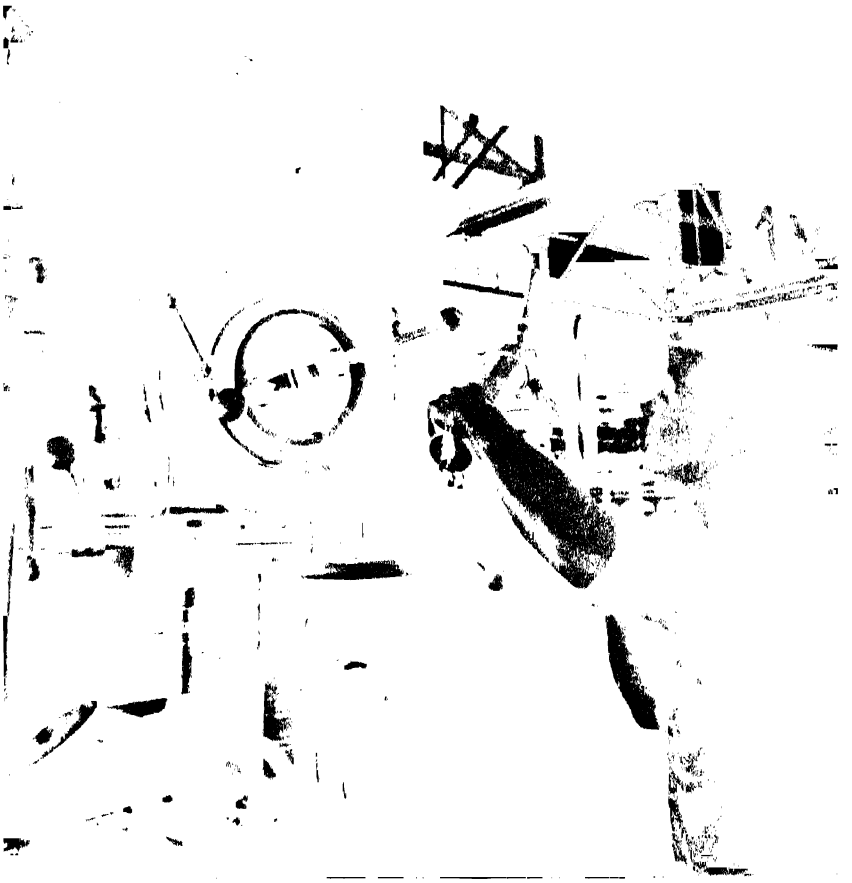
a view to eliminating any odd items. If, for example, it was found that a certain lubricant was suggested for only one or two applications, an examination was made to see if this could not be replaced by some other oil in more general use.

Log cards were then prepared in triplicate for each machine. Each card gives full particulars of the parts to be lubricated, the type of oil to be used in each case, and the frequency of application. Items requiring a periodical change of oil were indicated with an asterisk, and space provided on the reverse side of the card for filling in the date on which these changes were made. One card was placed in a transparent envelope and attached to the machine, the second filed for reference in the office of the oiler leadman, while the third copy was filed in the office of the engineer responsible for plant lubrication.

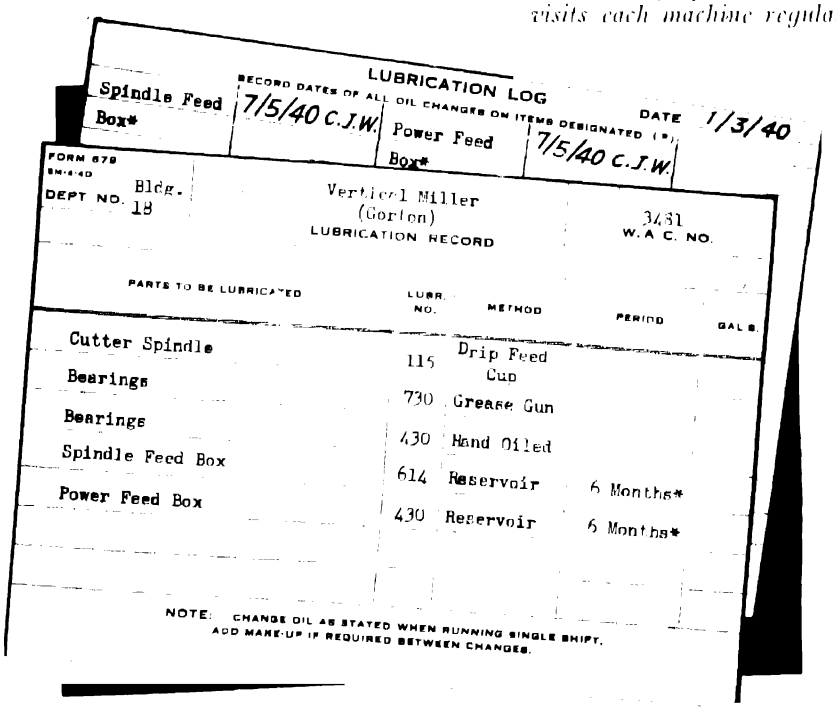
Each individual operator now is held responsible for the daily hand oiling of such parts as require this lubrication, but a special corps of oilers attends to all other lubrications. These men are under the control of a leadman who is responsible to the supervisor of the machine repair department. It is their duty to check all machine reservoirs daily or weekly, as required, and at stated intervals to pump out the oil from hydraulic systems and gear cases, and replace it with fresh oil.

Each oiler has a small two-compartment oil cart equipped with separate pumps for clean and dirty oil, and is furnished with such hand-operated grease guns and oil cans as he may require. In addition, special oil trucks have been designed for use in large departments. These serve as portable supply bases. These large trucks carry six tanks, holding about 70 gal. each, and are equipped with a sufficient length of hose to reach any machine from the aisles. Used oils of different types are kept separate so that they can be put through a reclaiming process and restored to their original condition for re-use.

In order to avoid confusion each lubricant has been given a three-figure code number by which it is known throughout the plant, and which is stenciled by the vendor on the head of each drum of oil. The last two digits, when multiplied by ten give the normal viscosity of the oil at 100 F., while the first digit designates the type of oil.



In addition to changing oil in hydraulic systems and gear cases, the oiler visits each machine regularly for a lubrication check-up



LUBRICATION LOG

RECORD DATES OF ALL OIL CHANGES ON ITEMS DESIGNATED (*)

Spindle Feed Box* 7/5/40 C.J.W. Power Feed Box* 7/5/40 C.J.W. DATE 1/3/40

FORM 679 SM-4-40

DEPT NO. Bldg. 18 Vertical Miller (Gorton) LUBRICATION RECORD 3481 W.A.C. NO.

PARTS TO BE LUBRICATED	LUBR. NO.	METHOD	PERIOD	GALS.
Cutter Spindle	115	Drip Feed Cup		
Bearings	730	Grease Gun		
Bearings	430	Hand Oiled		
Spindle Feed Box	614	Reservoir	6 Months*	
Power Feed Box	430	Reservoir	6 Months*	

NOTE: CHANGE OIL AS STATED WHEN RUNNING SINGLE SHIFT. ADD MAKE-UP IF REQUIRED BETWEEN CHANGES.

A lubrication card is prepared for each machine—a copy of this card is kept in a special transparent envelope at the machine so that the operator and the oiler each may know which lubricant to use



A Republic pursuit ship rolls off the assembly line. All component parts are jig assembled. This means more men available for minor and major sub-assemblies and faster plane production

Jigs for airplane assembly

BY H. LASKER, CHIEF TOOL ENGINEER, REPUBLIC AVIATION CORPORATION

All plane sub-assemblies are made in accurate jigs. Parts from these jigs match within close limits in later assembly jobs, thus speeding production

MASS PRODUCTION of planes is the goal of the aircraft industry. The Republic Aviation Corporation has attained this by using jigs for all minor and major sub-assemblies, as well as for final assembly of complete planes. The theory is—the greater the number of unit sub-assemblies into which a plane can be divided, the more jigs can be used, the more men can be employed on fabricating and assembly operations, and the faster will planes roll off the assembly line.

When a new plane is designed, the engineering and production departments confer to determine how many unit sub-assemblies are necessary for economic production of the number of planes to be built. Then a jig for each part, whether it be a wing rib or entire fuselage section, is designed with few if any removable parts so that the sub-assembly can be removed when completed without disturbing any part of the jig. Thus, the assembly men are in no way concerned with handling jig parts, and all sub-assemblies from any one jig are identical. This being true of all sub-assemblies, they mate in jigs during subsequent assembly operations.

Take the Republic fast pursuit ship which is now being built for export trade. It is divided during manufacture into two major groups — fuselage and wing. The fuselage is further divided into front, middle and tail sections, which when completed are spliced together in a jig and moved to the final assembly line. Here the fuselage meets the wing sub-assembly as a center panel, left-hand and right-hand outer panels and wing tips. For final assembly, the center wing panel is mounted on a rolling jig. The fuselage, outer wing panels, wing tips, engine assembly, retractable landing gear, tail surfaces, control surfaces and all accessories are added as the plane proceeds down the assembly line.

The fuselage is of all-metal semi-monocoque construction and is approximately circular in cross section. Essentially it consists of continuous longitudinal stringers, bulkhead or frame rings and a stressed skin riveted to the stringers and bulkhead rings. Engine-mount reactions are carried into the structure by four main box-section longerons.

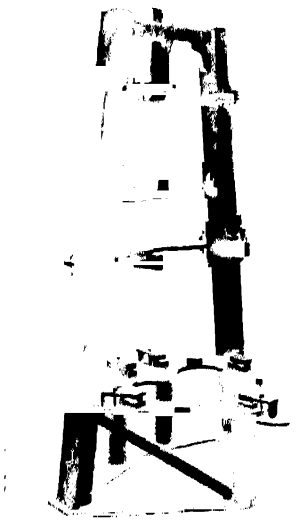
The wing is of full-cantilever design and tapers in plan form and thickness. Five main spars with fore-and-aft ribs give the necessary torsional rigidity. The center panel is bolted to the fuselage and contains fittings and wells for the retractable landing gear as well as most of the trailing edge flaps. The outer wing panels, spliced to the center panel,



Sub-assembly of the front fuselage section is typical of mass-production methods used in making Republic planes. The attaching points for the minor sub-assemblies which make up the front section are welded in position. On the other jigs for this section, the attaching points are welded in identical locations, consequently, front sections from any of the jigs are duplicates and each will match in subsequent assembly jigs

The tail section of the fuselage, assembled in the jigs at right and below, is made from jig-assembled minor parts such as ties, stiffeners and bulkhead rings. Each is drilled accurately and jigs itself as assembly proceeds. There is a minimum of fastening joints on all jigs so sub-assemblies can be removed easily when completed





carry the rest of the trailing edge flaps and the ailerons. The fuel tank is an integral part of the wing.

Each section of the fuselage and wing is jig assembled, and form what will be referred to as the major sub-assemblies. Minor sub assemblies consist of spars, ribs, bulkheads—in fact, any part which is sub assembled to form parts of the major sub-assemblies. We will first concern ourselves with the major sub assemblies.

Major sub assembly jigs are of welded tubular or angle iron construction with angles and plates welded thereto to form fastening points for previously prepared minor sub-assemblies. The latter having been jig assembled and drilled accurately, jig themselves as work proceeds. Thus a minimum number of fastening points are required on a major sub assembly jig, and it is relatively easy to remove the major sub assembly from the jig when it is completed.

All jigs are imbedded in concrete, leveled accurately and maintained by expert toolmakers. Assembly men are not required to remove parts of the jigs, except bolts or dowels, when removing a completed sub assembly.

Fuselage Made In Sections

The fuselage is first sub assembled into front, middle and tail sections and later spliced together. Bulkhead rings, the fire-wall, flooring, brackets, stringers and skin are completely drilled for further assembly.

The front fuselage section is assembled in a jig of tubular L shaped construction. There are fastening points on the horizontal leg of the jig for bulkhead rings, and at four points on the vertical leg for the fire-wall and longerons, which carry engine-mount reactions into the structure. The bulkheads are bolted in place. The longerons are added to stay the bulkheads. Brackets, flooring and accessories are installed, followed by the stringers which are riveted to the bulkheads. The skin, comprised of flat sheets previously sheared to shape and drilled, is finally riveted to the stringers. The assembly is removed by unbolting it from the vertical and horizontal legs of the jig.

The mid section of the fuselage is first assembled in left hand and right-hand halves split in a vertical plane through the longitudinal axis of the ship. Both halves are assembled in



The halves of the fuselage mid-section are mounted in this jig and spliced together. Note the staggered arrangement of the skin sections riveted to the stringers; this facilitates splicing the three fuselage sections and prevents undue strains of the ship structure

one jig of tubular construction which tapers in opposite directions from a center column, the taper being that of the fuselage lines. This arrangement permits easy access by mechanics for assembly operations and installation of control brackets, electric wiring appliances, flooring, radio parts and other accessories. The jig has fastening points only for the bulkhead rings, six of which are used. When these are in place, stringers and horizontal stiffeners are added to stay the rings. Brackets, flooring, and accessories are installed, followed by application of the skin. The two halves are removed from the jig by unbolting the bulkhead rings and set upright in an inverted-cone position on another jig. The latter is merely a plate cut to match the large end of the mid-fuselage section, and set on four legs imbedded in concrete. The mid-section is completed by splicing skin strips at over-lapping points.

The tail section of the fuselage is a highly stressed unit since it transmits loads incurred during both flight and landing. The jig employed in assembly of this section is illustrated. There are attaching points for four bulkhead rings which when in place are used to locate and hold four bridges or ties. These are of heavy section and designed as uniform-load structures to replace stringers used in the front and middle sections. Additional circumferential stiffeners, as well as tail-surface and tail-wheel attaching brackets are applied. The entire tail section is completed before the skin is applied, thus avoiding difficult assembly operations in restricted space.

Fuselage Splices Staggered

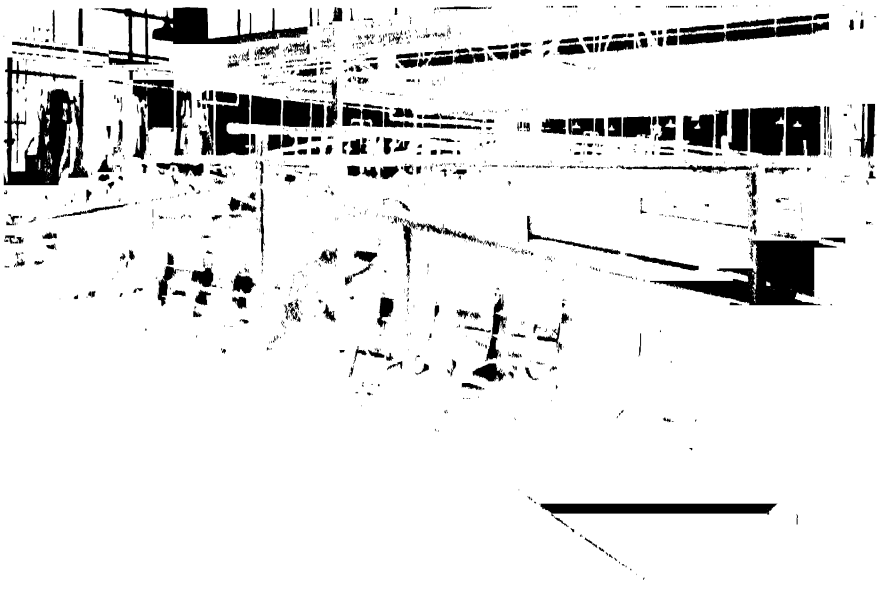
The three fuselage sections are spliced together in a jig with fastening points at the end and middle of the tail section, at the center of the mid-section, and at two points on the front section. The latter are at points used later to attach the center wing panel. The jig is merely vertical tubular-section columns embedded in concrete at appropriate spacings. Angle-iron brackets, some pivoted and some rigid, are mounted on the columns to form attaching points for the tail and middle fuselage sections. The attaching points for the front section are steel plates welded to a rectangular tubular structure. One of the illustrations shows an empty jig in the foreground and assembly operations of the entire fuselage in the background.

The skin of the three fuselage sections is left in staggered formation during sub-assembly to facilitate splicing and to avoid too great a strain on the ship at the splice points. This is clearly shown in the illustration of the fuselage assembly. The splice between the front and middle sections has been made, skin fasteners are in place, and mechanics are riveting the sheets and stringers. Other mechanics are splicing stringers and the skin between the tail and middle sections. After splicing, minor sub-assemblies, such as the crash protector, turtledeck, canopy track and windshield are added; however, the latter is removed after a proper fit has been assured.

At this stage, the fuselage is inspected and when approved is sent to the assembly line.

In the meantime, the engine is mounted on a tubular frame, which attaches to the four longerons in the front fuselage section. This assembly, together with many sub-assemblies, are sent to the assembly line. The latter includes stabilizers, elevators and rudder for the tail section; nose cowling, preheater, flap rings and flaps, and cowl panels for the power-plant section; and miscellaneous parts such as turtledeck and cockpit enclosures, windshield, fairing fillets, landing-gear fairing, and air scoops.

The wing is made up of a center panel, left- and right-hand outer



The mid-section of the fuselage is assembled in left- and right-hand halves in this jig. Mechanics have easy access to the section for assembly operations and installation of flooring, brackets and fixtures for radio and electrical equipment. Only the bulkhead rings are attached to this jig, a sufficient number of which are used to meet production demands

panels, and left- and right-hand wing tips. Spars, ribs, leading and trailing edges, corrugated sheet and flat sheet for the skin, landing gear and control-surface brackets, and miscellaneous accessories arrive at the assembly stations completely drilled for further assembly. When completed, the outer panels and wing tips are spliced together and with the center panel are sent to the assembly line as individual units.

Two Assemblies From One Jig

The jig for the center panel is designed to take two complete panels. It is constructed of tubular sections welded to form a rectangle split at the center by a vertical column. Plates welded to this center column and to the outside vertical columns serve as fastening points for spars. Additional fastening points are located on the top and bottom horizontal members of the jig.

Spars of built-up I-section are bolted to the plates on the vertical columns of the jig. Leading and trailing edges are added and fastened to both the spars and horizontal jig members. The fore-and-aft ribs are then riveted to the spars and leading and trailing edges, each rib section jigging itself by virtue of accurately space holes drilled during sub-assembly in jigs designed for that purpose. All necessary stiffeners, brackets and accessories are added before the skin is applied to avoid working in restricted space

Corrugated sheets and skin sections are riveted to the spars and ribs on the top of the panel, while stringers are riveted to the under side. Flush riveting is used, the skin sheets having been dimpled for this purpose.

Incorporated in the center panel is an integral fuel tank, which is formed by the structure itself, the ribs and spars acting as end plates and baffles. Prior to riveting the skin to the under surface, the partially completed panel is removed from the jig and the fuel tank is water tested for leaks. Skin is then applied to the under side of the panel with riveting being done through a series of inspection holes. The fuel tank is given a final test with air under low pressure. When the panel finally comes off the jig, splice points for fuselage and outer-panel joints are drilled. It is then sent to the assembly line.

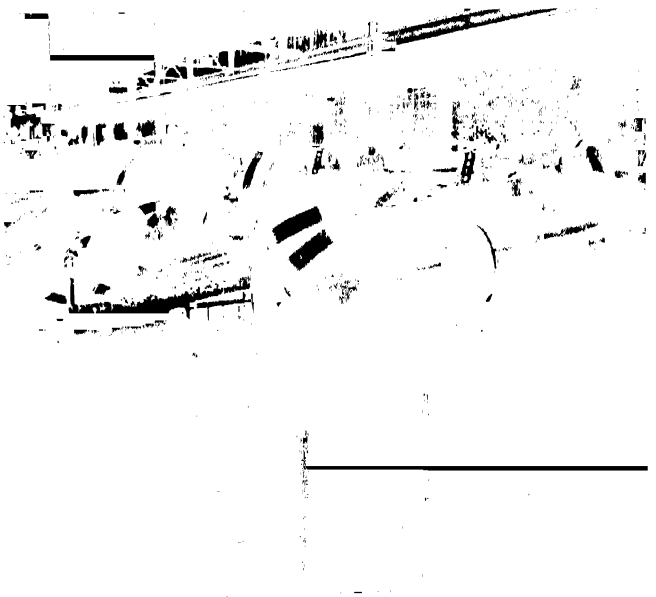
Each jig for the outer panels is designed for the assembly of one left-hand and one right-hand panel. The wing assumes considerable taper along the trailing edge as soon as it leaves the center panel splice; therefore, the outer panel jig is designed to conform to this shape. It consists of five vertical tubular columns of varying height. The center column, which is the tallest, is the dividing point between the left-hand and right-hand panel. An angle iron is welded to the top of the columns. Attaching points for panel parts are welded to tubular sections and lightweight angles, which are in turn welded to the angle iron mounted on the vertical columns. Additional attaching points for the outer-panel sub-assemblies are provided by plates welded to the vertical columns located between the ones at the ends and center of the jig.

Similar to center-panel assembly, spars, landing and trailing edges, ribs, brackets, accessories, corrugated sheets and skin sheets are assembled in order. Each of these parts made previously in sub assembly jigs are drilled accurately to jig themselves as assembly of the outer panels proceeds. A minimum number of non-movable fastening points is required, both for outer and center panels, which facilitates removal from the jigs and assures identical assemblies.

The wing tips are jig assembled from ribs, stiffeners and flat sheets. The tips are spliced to the outer panels just prior to movement to the assembly line.

Rolling Jigs for Final Assembly

On the assembly line, the center wing panel is bolted to a rolling jig, which together with another jig that supports the tail, remains in place as the plane proceeds down the assembly line. Before the first movement, the fuselage is bolted to the center panel. Then the plane is moved from station to station on the line as retractable landing gear, wing panels, power plant, tail surfaces, ailerons, cowling and nose sections, appurtenances and appliances are added.



The three sections of the fuselage are spliced together while held in a jig formed by vertical columns embedded in concrete and set at accurately spaced intervals. Attaching points, some pivoted and some rigid, are placed on the columns. Splices are staggered



Left-and right hand outer wing panels for each plane are assembled in one jig formed by five vertical tubular columns of varying height, the center column being the dividing point between the halves. The top member of the jig conforms to the wing taper

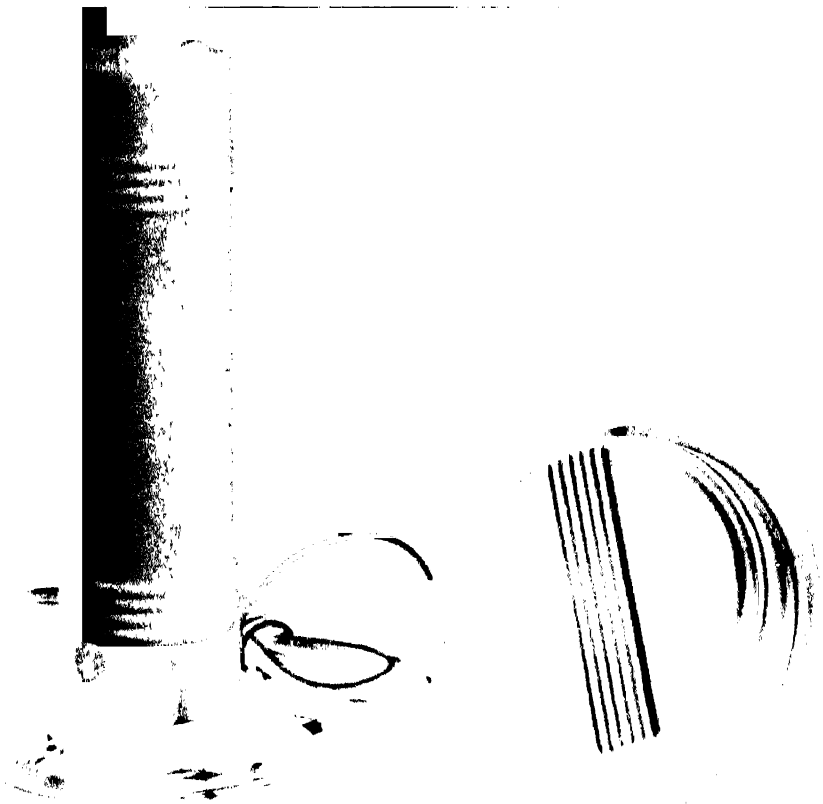


Fig. 1—The base for this ornamental lamp was embossed between bronze pieces cast in plaster molds

Tools of cast bronze

BY MARK GOLDEN

Jig and fixture parts, punches and dies are among the unique uses made of bronze castings in turning out limited lots

LONG USED in the production of castings for such ornamental parts as ash trays, book ends, handles for silverware, and similar parts cast from lead or zinc base alloys, bronze molds now are being used as jig and fixture parts for holding irregularly shaped objects. Also bronze castings have been used successfully for making forming and embossing dies for low-quantity production requirements.

In Fig. 1 is shown a lamp base with ornamental cross lines. These lines are embossed at the bottom of the stroke of the press, the top part of the drawing plug and the knock-out plug being bronze castings. While it is the general idea that die parts must all be made of steel, it is surprising how well hard bronze will stand up in this service. The die for making these lamp bases had, at the time this article was written, made about 70,000 pieces, and the two bronze parts of the die still were in fine condition.

To illustrate the ease of making bronze molds for these purposes, the production of a plaster mold for casting the bronze mold for making the lamp base shown in Fig. 2, will be discussed in detail. As the base of the wood model in this case is flat, it is placed on a sheet of plate glass, which will give a flat surface for the parting line between the two parts of the mold. Plasteline (modeling clay) is used to fill any slight opening between the mold and the glass, and to prevent movement of the model.

A wall or dam is formed of thin tin strips to confine the plaster when poured. The wall, shown in Fig. 3, is kept in place with plasteline around the bottom edge of the tin strips and at the corners. To prevent the plaster from sticking to the mold, it is coated with a parting medium made of an ordinary candle dissolved in kerosene. The kerosene evaporates, leaving a thin film of wax.

Plaster of paris is mixed by shaking the plaster into water. Mixing is carried on until a consistency of heavy cream is obtained. This mixture then is poured to a depth of about $\frac{5}{8}$ in.

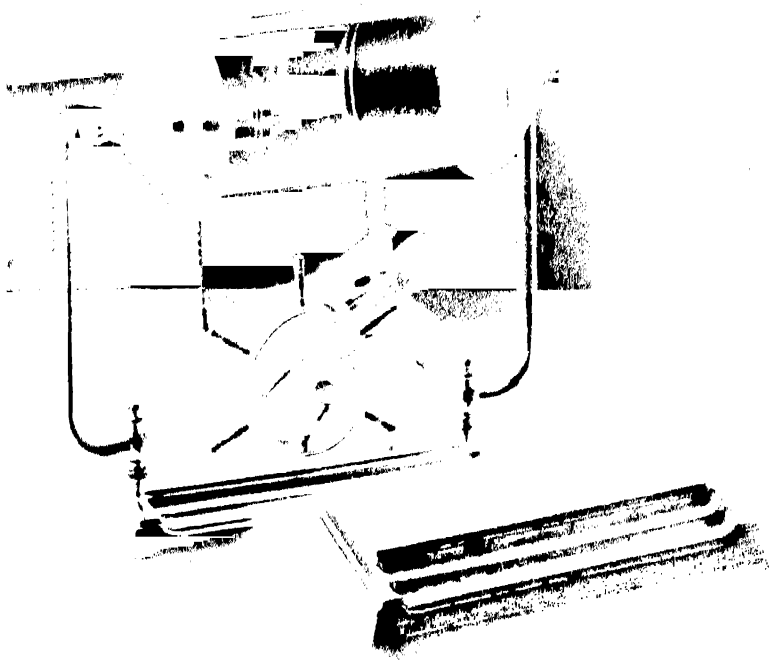


Fig 2—The base for this reading lamp is made from an alloy of zinc and aluminum and was cast in bronze molds

alignment The first cast with the model imbedded is next prepared with tin strips and Plasteline as shown in Fig 4 It is coated with the parting solution to prevent sticking of the second casting.

Second Cast Like First

A second lot of plaster is mixed and poured After this plaster has set the tin strips are removed and the two parts are easily separated because of the wax coating on the first half of the mold The plaster is trimmed to remove excess material so that about ½ to ⅝ in is left all around The two halves are cut along the lines previously marked by indelible pencil to form the gate for pouring the metal to be cast The back of the plaster cast is marked with a circle ⅝ in in diameter to designate the point at which a shank is to be cast This shank is used for handling the mold in operation

The two halves of the mold are finished by hand, using scrapers, riffle files, and punches A motor with flexible shaft is frequently used to save time and labor In Fig 5 is shown the finishing of the mold top

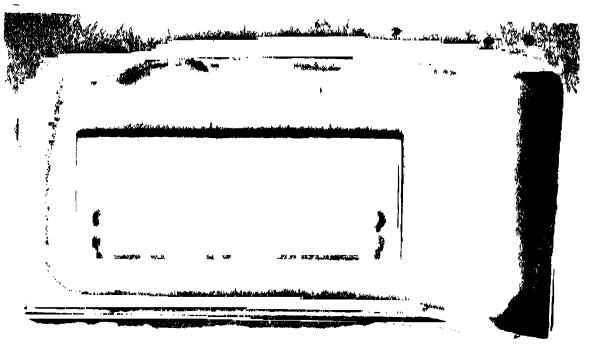


Fig 3—First the model is placed on a sheet of glass and a wall of tin strips is held in place around it with modeling clay

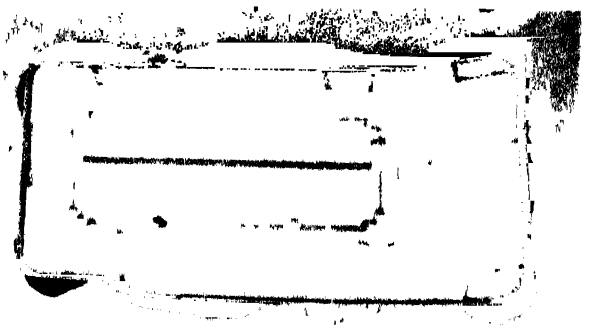


Fig 4—The first plaster casting still with the model in place is turned over and arranged for casting the second half of the mold

over the highest part of the model The plaster then is allowed to set until it hardens The plaster warms up as it gets hard and the cast cannot be removed from the form until it has warmed up, or the casting will break

The model next is prepared for casting the second half of the mold Locks are cut in the plaster and the pouring gate is marked with indelible pencil The locks locate the two halves of the mold accurately The line marked with indelible pencil will be transferred to the second half of the mold, due to the moisture of the plaster This permits the pouring gate to be cut in both halves in accurate



Fig 5—The mold halves then are finished with hand tools to make them ready for casting the bronze pieces

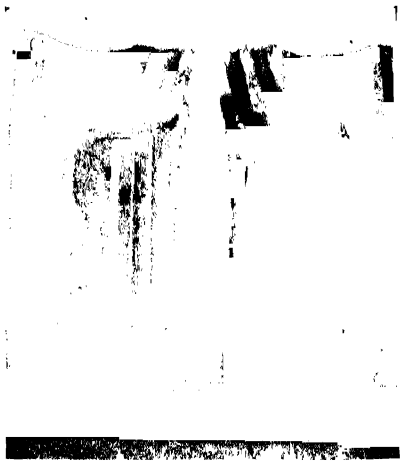


Fig. 6—These bronze molds cast from plaster parts have been in use for more than three years and have cast thousands of lamp bases

to remove on this type of casting.

There are two types of metal used for casting in bronze molds. The first, and original metal used in this work, is a lead composition consisting of 86 to 88 per cent lead, and the balance of antimony to give hardness. The second metal was developed to overcome the fragile qualities of the lead composition. This second type contains 94 per cent zinc, and 6 per cent aluminum, and is known as "unbreakable" metal. It very nearly lives up to its name, since it takes a good blow with a heavy hammer to crack an ordinary casting.

In making the bronze parts for the die to emboss the lamp base shown in Fig. 1, a cylindrical plug of plaster paris is cast in a form made of thin sheet steel bent into a tube 5 in. in diameter. The tube is placed on a flat surface and reinforced with modeling clay. After the plaster cast in this mold has set, it is turned to the proper shape in a lathe. In this instance, it is turned to the shape of the male member. The ribs are made by brushing white shellac over the parts and then dry plaster paris is built up on the pattern. The plaster will not adhere to the pattern unless it first has been shellacked to close the pores.

After setting, the lines are carefully laid out in pencil and rough cut by knife. The finishing is done with a flat piece of steel filed to the proper shape. When the male pattern has been completed, the pattern is brushed with the separating medium made from candle and kerosene, and the steel tube is placed around the casting to prepare for making the female part of the die. This part of the work is done as in casting the second part of the mold described above. When the plaster has set, it is trimmed in the lathe. Corresponding "V" notches are cut on the periphery of the plaster halves so that these halves can be matched when fitted together for making the castings.



Fig. 7—A bronze casting made from a plaster master is used in this drill jig to position an anchor for a decorative lamp

half with hand tools. When ready for casting bronze molds, Fig. 6, the two plaster mold halves are fitted together using a mixture of whiting and alcohol.

The mold described above is for solid castings. Another type is used for making thin hollow castings. The molds are called slush molds, since the metal poured into the mold is slushed around and poured out into the ladle. Since the bronze mold is never allowed to become hot, the poured metal leaves a layer of metal on the inside wall of the mold.

Water-Glass Stops Sticking

The pouring gate on solid castings sometimes is broken off. At other times it is sawed off, depending on the casting. In the case of slush or hollow castings, the edge of the gate is painted with silicate soda (water-glass). This resists the tendency of the metal to stick to the wall of the mold. There is, therefore, no gate

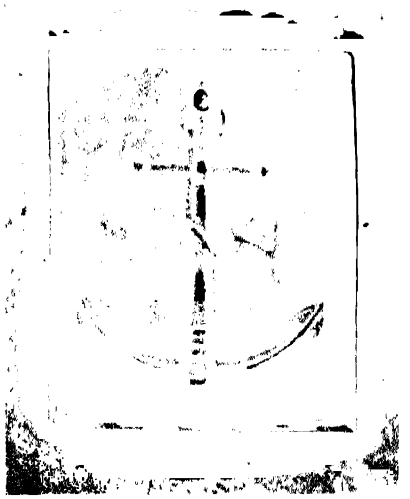


Fig. 8—This mold was used for casting the bronze part shown in Fig. 7. Modeling clay is used to build up to the center line of the part in making this mold from the sand-cast piece

Castings for Jig Parts

A novel use for bronze castings is in making jigs and fixtures for machining operations. A good example of this use is the drill jig for a cast anchor shown in Fig. 7. This anchor is part of a marine-design table lamp. In making the plaster pattern, the anchor was imbedded in modeling clay to the center line and a frame formed of thin steel strips imbedded in the clay. In Fig. 8 can be seen the anchor prepared for casting the plaster. After the plaster sets, the steel strips were removed, and the plaster cast removed. The casting resulting from this operation was then trimmed to remove excess plaster and shellacked. The bronze casting made from this pattern is machined and the casting fitted into the impression by filing. Where small pieces are to be handled, the shrinkage of the bronze is not enough to cause excess labor in finishing. On large pieces, it is advisable to enlarge the impression in the plaster a little in order to save work in finishing the bronze part.

The bronze block is mounted in a cast iron jig, to make the completed unit shown in Fig. 7. Two bushings for No. 33 drills were inserted in the projecting block at the top of the jig. A No. 18 drill bushing was put in the jig cover. A pressure button is also located in the cover at the proper point to apply spring pressure to hold the casting firmly in position during the drilling operation.

Still bewildered

ANONYMOUS

Not long ago I read your editorial, "Bewildered—Not Lost." I feel many other men who read it had the same reaction I did; I could hardly believe my eyes!

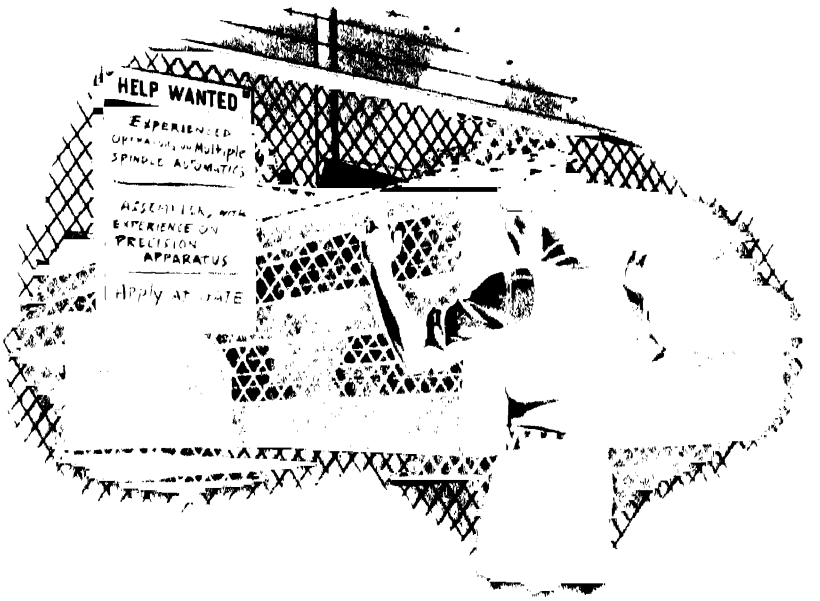
IS IT POSSIBLE that a business paper can publish a pep talk like this, which might have been applicable twenty years ago, but which certainly does not take into consideration the conditions that exist today? Let me picture for you John Doe's Jobbing Machine Shop, and you will see that the title is true, but in an entirely different sense than intended.

John Doe employs 50 men. When he is busy, he can build this force up to 100, and at such times feels the need for skilled men very badly. His shop is 100 per cent union, pays union wages, and follows all the rules laid down by the NLRB without getting into too much trouble. For years he has had apprentices, giving them a four-year course in which they learn all he can teach them. There is plenty of supervision to help them learn their trade, the shop has modern machinery of various kinds, and several of them, emboldened by their success, have branched off into the mechanical business.

If you assume that each of these 50 employees has a son who might want to follow in his father's footsteps, there should be an opportunity for at least 25 men to learn the trade—but is there? The answer is definitely no! The union regulation is very strict, there can be only one apprentice to ten employees, and so this shop can have only five apprentices, and, mark you, one of these must finish his whole four years before another can be taken on.

You might assume that the practical thing to do would be to point out the danger of this restriction, to show the men that these tactics, laid down by some union organizer, will only tend to keep their sons on relief. Perhaps they should be told the truth: that this artificial scarcity will not result in fabulous wages, for wages are entirely dependent upon the consumer; that Mr. Doe would be tickled to death to make a five per cent profit on wages of $3 an hour instead of $1, if he could get this kind of money for his work. But this simple lesson in economics can never be given, because the law says it is "coercion," and heavy fines and jail sentences are imposed for just such criticism, which is construed to be an attack on the unions and their tactics.

The front door of John Doe's shop opens, and a man comes in and says:



Isn't it pathetic to realize that this young man is facing strangling regulations to prevent him from ever learning a trade properly?

"I saw your ad in the paper, and I can run a lathe a little; I worked at Brown's and I need a job. I don't want to be on relief. Can't I start in? Pay me only what I'm worth."

John tells him he can't use him, but he's not permitted to tell the true story. He can use him, yes; he has work he could do well enough. But these are the restrictions: First of all he must join the union; if he is a new member he must pay an entrance fee; if he previously belonged and dropped out there may be a $25 fine (after six months on relief, where can he get it?). Furthermore, if he is hired and runs a lathe he must be paid $1 an hour. John knows he can't earn it (and never can until he gets experience), and so he dares not hire him, let him learn more about the business, and take him off relief.

And then there is seniority. *A* and *B* are planer hands, who have worked for John Doe a long time. They have been laid off during slack periods, but they always come back. They must, because they are not good enough to get a job in open competition. But during a busy period John hires *C*, who, strange as it seems, is a good machinist, much better than *A* or *B*. If *C* could be kept employed the shop could take work in slack periods, work that would provide jobs for helpers, and lathe hands, and bench men; but *A* and *B* are not capable of doing such work, and if *C* does it, *A* and *B* must be working, and their wages, entirely unearned, added to the cost of the job. So John Doe bids and loses the work, and half a dozen men collect unemployment insurance. This is seniority.

Perhaps John Doe gets slack, and a lot of his men take time off. The good ones could find work, but to take a job costs them their seniority, and so they stay at home, collect

government dole, and look at their sons who have small chance to learn a trade and support their parents in the future. This also is seniority.

A few weeks ago John called in the union committee, and the organizer. "Boys," he said, "you all know Joe. We hired him as a laborer a few years back. He's done pretty well. You know he supported his mother till she died, and now he wants to get married. He's too old to be an apprentice, but we can get a lot of shaper work now, and I want to put him on this machine. I'll give him a raise, and when he gets good enough I'll pay him the regular rate. That way he'll learn some kind of a trade, and will be able to get a job if we get too slack and have to lay him off. He isn't going to take any other man's job, because I can get work just for him. I can't pay 90 cents an hour, and I can't get work at a price that will stand it, either. What do you say?"

Can you guess the answer? That's right, it was no. And Joe has never been told, and never will be.

Stay on Relief

Day before yesterday John Doe had another session with the committee.

"We're mighty busy now," he began, "and I want to put on two new apprentices. You all know Frank, the errand boy, and Eddie, Barney's son. Barney wants him to learn a trade, and if he's as good as his father and brothers, he'll be a good man.

"Now I know we've got our full complement of apprentices, and ought to have twenty more men before we put these kids on. But Sam and Denny will be through their time in three months, and meanwhile we have a lot of work, and these kids will get a good start.

"We've tried everywhere, advertised and everything, and have only been able to get five men. You fellows know I'd hire 25 men tomorrow if I could find them, and I could get work for them, too. Barney's kid will do all right, and so will Frank. I don't want to crowd you on the rules, but you can see how it is. With more man power, I can take more work and have jobs for all the mechanics, and for a longer time, too. How about it?"

Do you know the answer, Mr. Editor? Yes you do too! And can Barney be told all this, that his son better go on relief for another six months? Yes, John can tell Barney this, but he can't tell him why. This, my friend, is criticism, and therefore "coercion," and by the same measure illegal.

Six months ago a man came in to see John Doe. He introduced himself as a professor in a local vocational school.

"We are trying," he stated, "to teach our young men the kind of mechanical knowledge that will be of actual practical value when they go out to get a job. I have here a list of questions, which I would appreciate your answering; I would like to see the kind of work you do, and what blue prints you work from; and will you tell me exactly what I should teach my students, so that when they finish the course they will know exactly what you yourself would want them to know?"

The boss told him what he wanted to know, but what he didn't tell him was that his students would never get a job with him, because he must either pay them the full union rate (which they couldn't earn), or if they could bluff their way enough to get a job running a machine, they would be shackled by the system to running that machine until they died, without a chance to work at the machinist trade which they had selected.

"I'm just past 21. I've had about two years of machine shop training. I can do any operation on a lathe, and I've had some experience with a milling machine, shaper and drill press. I would appreciate a chance in your shop either on day or night work. I'll work for any pay just so I can have the opportunity of working in a machine shop. I want to learn all of the trade I possibly can, because the work makes me feel good when I do it."

Half a dozen letters a week, just like this (this is quoted verbatim), and to what purpose? From them shine a pride, inherited from ancestors who faced the world with their skill in their two hands, and earned a living, and raised a family, and who should now retire to smoke their pipes in the sunshine on their children's porches. Isn't it pathetic to realize that this young man is facing strangling regulations to prevent him from ever properly learning a trade? Regulations that will force him (if he does find a job) to pay taxes that are used, not for training his children, but for continuing a system that will prevent new generations of mechanics from being trained to carry on the tradition of the greatest industrial country in the world.

What, Mr. Editor, would you do about that letter, about those untrained young men, about those half-trained older ones, when you realize that only one in ten has a chance at proper training, under a system fostered by government and maintained by strike and violence? Certainly American industry wants to train new men, knowing how badly they are needed, and fully realizing that some future "M-Day" will bring this home sadly to the population of the country.

Fallacy of Scarcity

The system of regulation that either sadly restricts the number of men trained in jobbing shops or discourages such training altogether is sold to American workmen on the platform of "scarcity"—that more mechanics will lower wages, put older men out of work and destroy their security. Only the press can point out the fallacy of this, by showing that the security of the nation and of the industry is the only thing that will make permanent jobs for the mechanics and their children.

Industry can be expanded, more men employed, and more uniform employment made possible, only if both industry and its workmen can be freed each to run his affairs as he sees fit, in open competition with no favors to anyone. Perhaps you could conjure up an industrial Abraham Lincoln!

Deep Hole Drilling

DEEP HOLE DRILLING in the machine shop is a special job that few like to handle. Rifle barrels usually run from 0.22 to 0.30 in. and are rarely over 24 in. long. Cannon usually run from 3 in. to 12 in. with a few of 16 in. The lengths may run up to 50 ft. But for real deep hole drilling the oil industry leads them all. Oil country shops think nothing of putting a 3- or 4-in. hole through a drill rod or shaft 50 ft. long.

So much for metal. When it comes to deep holes in the earth the record is 15,004 ft., with the lower 2,200 ft. only 6 in. in diameter. The mere thought of a drill nearly three miles long makes one wonder as to the torsion in the drill, the weight to be supported and the amount of power required.

Of course the holes are not straight, as is necessary in machine shop work. But it's a job that would cause many a headache to one without experience in this line.

Nothing but welding

BY WILLIAM A SALZMANN PLANT ENGINEER INTERNATIONAL HARVESTER COMPANY

Spot welding alone is used by International Harvester in the fabrication of truck cabs. The technique developed could be profitably applied elsewhere

USING SPOT WELDING exclusively, an interesting method of progressively assembling sheet metal stampings into truck body cabs has been placed in operation at the Fort Wayne plant of International Harvester Company With some 20 operators handling the 24 pieces of welding equipment, production is currently 90 cabs per 8 hr shift

Welding equipment is located so that parts from each welding station feed directly into the succeeding operation, eliminating interoperation storage and duplicated handling of sub assemblies The entire set up has a production line aspect, yet without the apparent urgency commonly associated with it Parts to be assembled are conveniently located at the various welding stations, where they are incorporated in the cab assembly as it is built up Latest type of hydraulic spot welding guns are used These, together with individual air hydraulic pressure boosters, transformers and the necessary special guns, welding fixtures, jigs, and other auxiliaries, were supplied by Progressive Welder Company

Tools Hang From Monorails

To conserve the operator's energy for productive work and save time in moving the portable equipment at each welding position, most of such equipment is suspended from overhead tramrails capable of being moved in two directions with minimum effort Except where installed in the welding fixtures, such equipment as transformers and air hydraulic pressure boosters are also suspended from the overhead tramrails

Automatic welding timers, supplied by Weltronic Corporation, are of the repeating type, eliminating dependence on the operator for correctly timing the weld The timer automatically controls weld, cool, and repeat time It also permits the operator to maintain pressure on the control button while making a series of spots, the off' time being sufficient for repositioning electrodes for the next spot

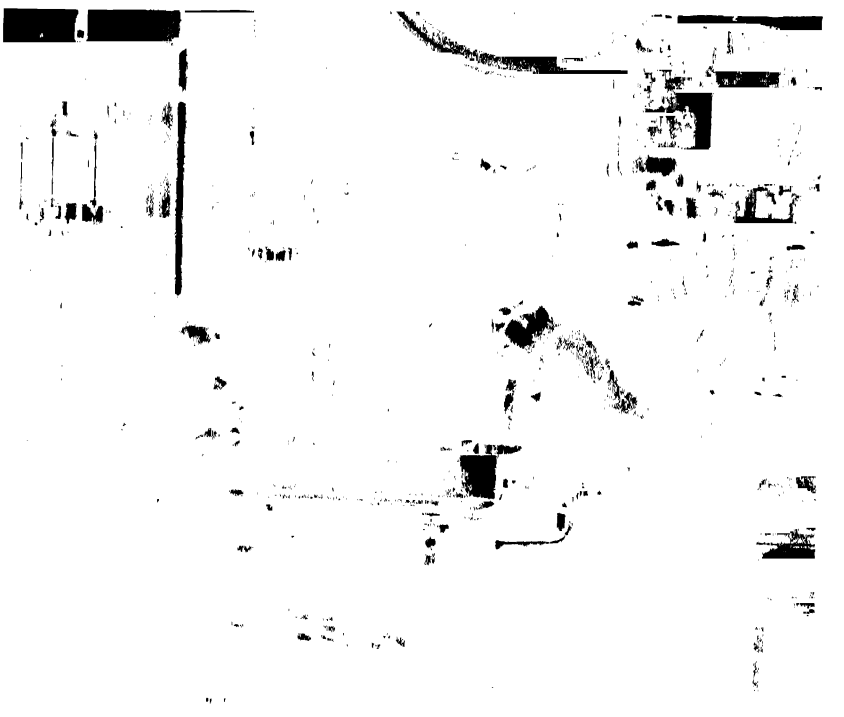
Under such continuous repeat operation, it is essential for the duration of each weld to be in exact conformity with the time called for by the timer setting Westinghouse Weld O Trol contactors of the Ignitron tube type are used at all welding stations Control of welding current with this type of contactor reduces sparking and welding point wear Timers and contactors are placed overhead adjacent to the tramrail supporting the equipment they control

General layout is such that two lines of spot welding guns and pedestal welders converge upon a single major cab frame assembly fixture Spot welding on one of these lines begins where two portable pincer type guns weld windshield panel to post, hinge pillars to post, and miscellaneous brackets, to form the H frame Both guns have independent transformers and timers, and are suspended on tramrails to permit rapid shifting in any direction

Some Welders Interchangeable

A pedestal welder used for welding bracer strips and clips to the dash on standard cabs is also used interchangeably for welding cowl assemblies for special cab jobs Another pedestal welder handles lock pillars, cowl, ventilators, reinforcements and miscellaneous parts to complete the operations of the first assembly line

The cab underbody is similarly assembled on the second line The sill frame is placed on a combination jig and welding fixture and on it the



One of the initial sub-assembly spot welding operations in the all-welded method of assembling truck body cabs at International Harvester's Fort Wayne plant Here underbody sub assemblies are being built up solely by means of spot welding



Top and back skin are assembled in this welding fixture, which has the transformer located in its base and the pressure booster and controls mounted on the cross arm. Scissors type expansion gun is in operating position



Major cab frame assembly fixture receives underbody sub-assembly from the line No. 1 and H frame from line No. 2 for assembly into completed cab frame. Four portable spot welding guns are used by three operators at this welding station, one working inside frame



In completing the drip mold welding operation, right and left hand door frame fixtures suspended from a tramrail follow the cab along conveyor line. Short cutting gun is used for both right and left hand doors, current being carried through fixture

underbody is built up. The various parts comprising the cab underbody are hand clamped, pinned in position and welded, two operators loading and welding the work. One gun is used for vertical spots while the other is used for horizontal work. They are independently suspended and have separate transformers, boosters, timers and contactors to permit simultaneous operation.

Welding on this line is completed at a second station. Here a swivel head gun, to allow access of points over deep work, permits the tool box and seat riser to be built up as an integral part of the completed assembly.

The two lines converge on the major cab frame assembly fixture. The underbody assembly and the H frame assembly are located in this fixture with hand clamps. Three operators using four guns complete the assembly of the cab frame and weld miscellaneous reinforcements. Two operators work outside the fixture, while the third working inside handles spots more readily accessible from the interior. The cab frame assembly is then removed from the fixture and placed on a body truck to be pulled along the main assembly line by a floor conveyor.

Station Strategically Located

While the assembly of the cab frame is progressing along the two welding lines, the assembly of the roof and back panel is being accomplished near the conveyor line loading point. In a self contained fixture the top and back are joined by a scissors type expansion gun. The rear window frame is positioned with double Y clamps and welded to the cab top with another pincer type gun. At

this same station the seat cushion back and reinforcing strip are welded in position. The cab skin is positioned on the cab frame on the conveyor line, and is immediately tack-welded along the bottom of the back panel to the frame to insure proper positioning.

A third pedestal welder is used for the cowl assembly. This welder completes the necessary welding of hood bracket reinforcements, hinge clips for ventilator and guide for rod brackets. Upper and lower cowl panels are welded with an expansion gun in a fixture, and the completed assembly is brought to the conveyor line and put in position. Two guns are used for welding right and left hand door frames to the skin and a third gun welds cowl to dash.

The next operation comprises an effective application of overhead tramrails. Here a fixture suspended from the tramrail carrying the transformer and pressure booster is lowered into the windshield opening to weld the top to the windshield. Work is secured with hand clamps and is welded by a spade-handle expansion gun. When this welding operation is completed, the gun is placed on the fixture and the complete equipment raised to permit the assembly to pass under it.

As soon as the inside trim has been welded on with a pincer gun, right and left hand door frame fixtures are swung into position and locked by an expansion rod. Both sides of the transformer are connected with the fixture. The operator handles the short circuiting expansion gun while a helper holds the drop molding in position until the first tack weld is completed. The helper then positions the molding just ahead of the next welding operation.

At this point the conveyor line travels over a hump which permits easier access to the lower portions of the cab. A single long-jaw pincer gun is used alternately by two men to weld the lower skin to the frame at the rear of the cab. Another deep-throated gun welds the kick plate to the cab sill, the plate having been clamped in position previously as the cab approached the hump.

Final spot welding operation uses a deep-throated pincer gun with offset electrodes to complete the welding of kick plates to the cab assembly. In the photograph above is illustrated how the hump provides clearance for these final welding operations, permitting the operators to have rapid access to the work without the necessity of climbing into the cab.



Final spot welding operations are completed on the conveyor hump. Tramrail permits one gun to be easily moved for operation on either side of the conveyor line

Forged Cavity Shells

By JOHN HAYDOCK

My reaction to the forged cavity artillery shell was somewhat the same as that of Lucien I. Yeomans (*AM*—Vol. 84, page 526) until I had an opportunity of investigating the method of manufacture used at the Frankford Arsenal. What I found convinced me that 75-mm. shells made without machining the bore will meet ballistic requirements, and that this is the sensible way to make them.

Consider the following:

The shells are not rough forged but precision machine forged. The bore is held within 0.020 in. of size and concentricity. The outside is held within $\frac{1}{16}$ in. runout with the bore. This control of runout means merely that the shell will clean up and when the stock is removed the difference in cutting pressure between one side and the other will not cause deflection.

Shells are indicated in the bore to assure proper size and roundness.

The arbor has six expanding contact pins—three at each end. The outer set is positively actuated and the inner set spring actuated, an arrangement which assures that both sets will grip the shell—that the contact of one set will not lock the other.

Pins are ground with the arbor in the spindle of the machine insuring concentricity in the working position. A master shell machined inside and out is indicated on the arbor daily.

Centering is done on this arbor. Subsequent operations are carefully designed to maintain the uniform wall thickness thus obtained.

In the past I have heard manufacturers complain of unnecessary operations caused by the insistence of Army and Navy specifications. It seems to me that the elimination of the boring operations on the artillery shell is a realistic step in obtaining economical production without unnecessary flourishes. Anything that makes the defense dollar go farther is a move in the right direction.

Steam Got Tired

I WAS INTERESTED in H. M. Lane's account of the straight line engine. It recalls a conversation with Prof. Sweet, something over 40 years ago, in his shop in Syracuse. Having worked on steam engines of the Corliss type, I asked how he could run without a stuffing box on the valve stem. His answer was typical, "I make the bushing so long the steam gets tired before it gets through."

Industry needs tape

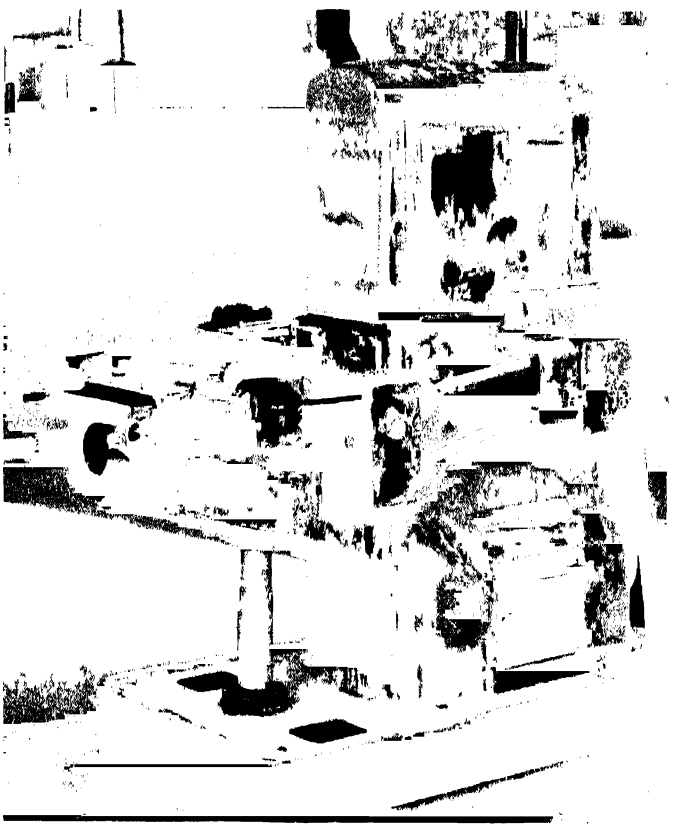
By E J TANGERMAN

Not red tape, of course, but 50 other varieties that mask, hold and protect metal parts

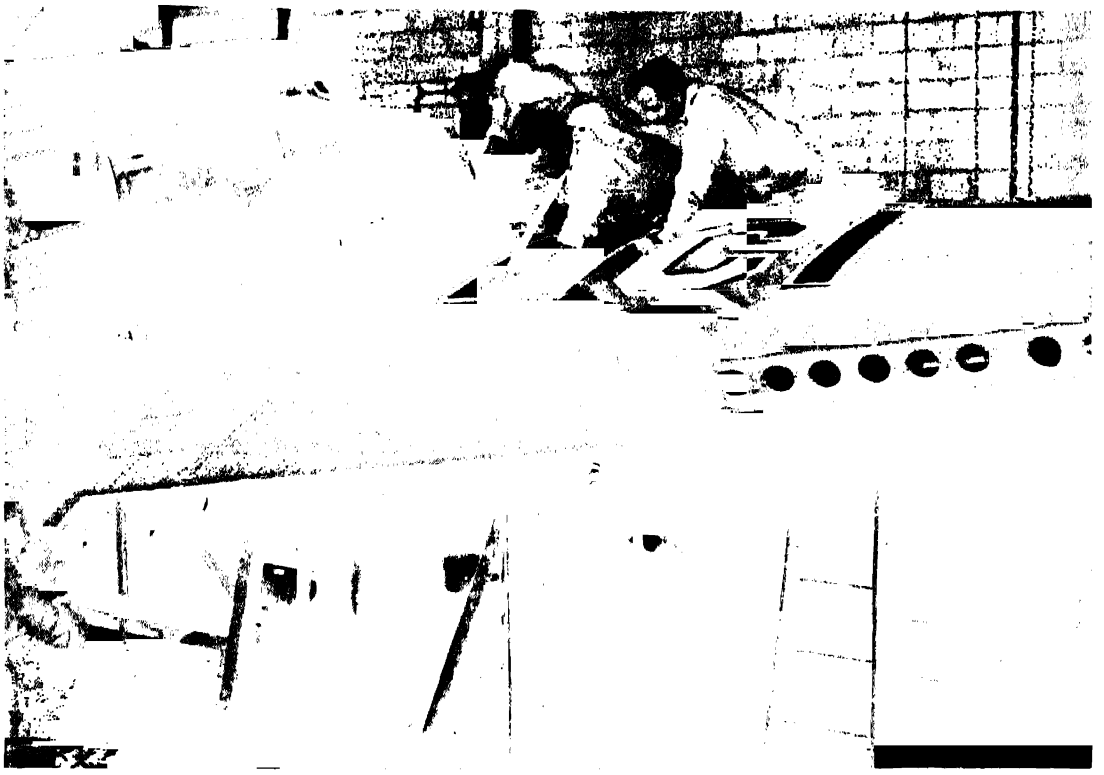
DURING THE past couple of years, adhesive tape has come out of the plant first aid room and is finding uses in dozens of processes Over 50 distinct types, varying widely in backing, tensile strength and adhesiveness, are available They are used for masking, protecting, holding, trimming, wrapping, insulating, sealing, and identifying Stock tapes come in 60 yard rolls in widths of ¼ to 3 in Backings vary to suit the job, including various cloths, papers, cellulose fibre, and rubber Commonest are the masking tapes, with plain or crepe paper backs, used to define the edge of a painted area and to protect areas not to be painted The crepe paper types can be "pulled" into any desired shape, as for example around the curve of an automobile windshield corner, or over the bezel and lens of a tail light The cloth backed tapes provide greater tensile strength and wearing qualities, while the rubber backed ones mask against sandblast or grit blast, and thus permit blast etching of designs, numerals, etc on polished metal surfaces Plain-backed paper tapes are now familiar in drafting rooms also for holding drawings and tracing paper, replacing thumb tacks It can also be used for outlining or masking out sections of tracings before blueprinting Cloth backed tapes with high dielectric properties are available for electrical insulating, and other cloth-backed types for holding enameled or painted elements (as on an oven door) during shipping, and for sealing shipping containers against air Typical applications are shown in these five photographs, furnished through the courtesy of Minnesota Mining & Mfg Company



Here used as a corner guide and protector in buffing a metal finish, masking tape is similarly applied for masking against spraying and for striping It can be cut to any special shape (which, if carefully removed can be used over and over again), and the crepe-paper-backed types can be made to follow any contour as around the lens and plated trim on a headlight, along the edge of a trimming strip window pane or panel, as well as for special designs such as trademarks



Rough surfaces of this milling-machine base have been filled and machined surfaces are covered with masking tape in preparation for painting Here, the machine face is protected with masking paper held in place by cellulose tape, while regular masking tape, cut to shape, serves elsewhere These masks can be removed after painting without staining or gumming the finished surfaces Similar taping is later done to hold padding and protective material over dials, handles, etc , during shipping, as well as to prevent rusting, or scratching from dust

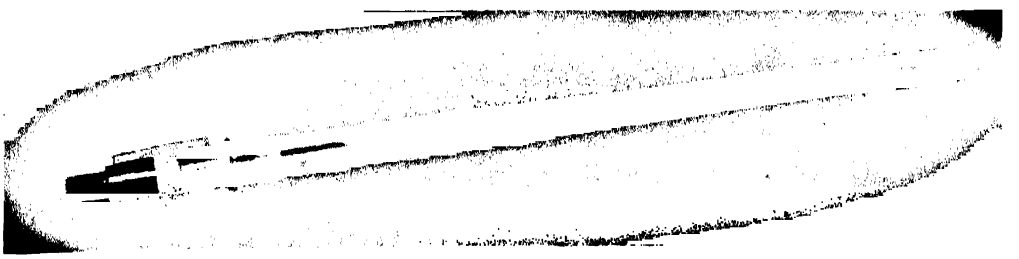


Aircraft and automobile plants were among the first users of industrial adhesive tapes—for every part of the job from insulating small coils to trimming upholstered interiors in contrasting colors. Here wing markings are being masked before spraying. The side of the fuselage has already been similarly stencilled. The tape sticks so closely that sprayed lines are sharp and even narrow stripes can be masked

Protection during processing is often a complicated problem. Here, two strips of tape hold masking paper aprons to prevent burning of stainless-steel surfaces from spatter during welding. Tape is similarly used to protect enameled surfaces of a refrigerator shell against burning from hot chips when door-hinge holes are drilled



Small parts have a way of becoming lost in shipment. Here a turn of masking tape holds a key securely in its keyway, and more masking tape will be applied to protect both splines and threaded end. Similar methods are used for holding spare bolts or nuts to an assembly, for holding doors (particularly with finished surfaces—as on a porcelain-enameled stove) closed during shipment. There are also double-faced types for holding small parts while painting or blasting, and these, as well as single-faced types, can be obtained which will withstand even sprayed water or drying-oven temperatures



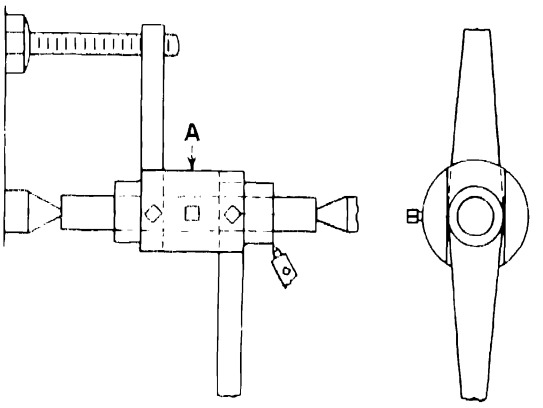
IDEAS FROM PRACTICAL MEN

Slotted Sleeve on Mandrel Holds Two Pieces

By H. MOORE
Leeds, England

The hubs of a large quantity of levers had to be turned and faced after they were bored. To do this a sleeve was slotted at the ends and was made to fit a mandrel of the same diameter as that of the bores in the lever hubs, permitting two levers to be mounted at one time, as indicated in the sketch. The slotted sleeve *A* was held on the mandrel by a setscrew and two other setscrews secured the levers in the slots in the sleeve.

This arrangement made higher rotative speed possible because the work was balanced. It also made the use of a dog unnecessary. After the hub of one lever had been finished, the mandrel was turned end for end, bringing the second lever into position and eliminating the necessity for changing or resetting the tool in the toolpost.

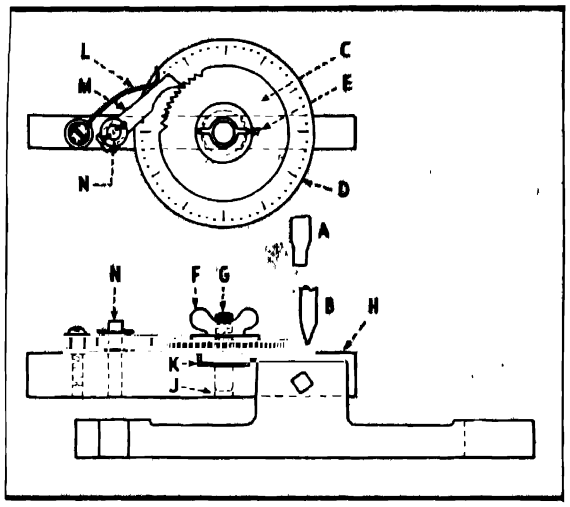


A sleeve slotted at both ends and mounted on a mandrel of the same diameter as that of the bores in the work held two levers at one time, balancing the work at high rotative speeds

Indexing Fixture Speeds Calibration of Dials

By ARAN AGHAZARIAN

We recently had to make a small quantity of clock dials on which 60 divisions were required. They were put through in a minimum of time with the aid of the illustrated indexing fixture operated by a foot press. The company's product being clocks, I was able to adapt a spare pawl, and a 60-tooth ratchet for the tool. The marking punches *A* and *B* were obtained from the toolroom.



This pawl-operated indexing fixture, operated by a foot press, served to stamp 60 division on a small order of clock dials

In operation, the ratchet *C* is located on the dial through one of the three fastening holes in the dial *D* by the stud *E* in the ratchet. The dial and ratchet are clamped together by wing nut *F* and shouldered stud *G*.

The stud *G* pivots this assembly on bar *H* through reamed hole *J*. The recess *K* in the bar is clearance for the shouldered stud *G*. Flat spring *L* backs up the pawl *M* which pivots between two washers on stud *N*. The entire assembly is mounted on a standard slotted-type die shoe. Punch *B* is first used to put the small impressions on the dials. Punch *A* is then substituted and the dashes are made at every fifth indexing point.

Riveters Clamp Plates To Be Shape-Cut

By W. J. TANGERMAN

Some time ago, we began to shape from scrap the blanks for pressing freight-car parts, such as hopper-car doors. We found the operation so economical that we have expanded it to the cutting of somewhat more elaborate blanks from new stock. However, we ran into some difficulty in the shape-cutting of packs of scrap plates, because many of them were bent slightly.

The obvious answer was to use some form of pressure clamp. As we cut twelve ¼-in. plates at once, a hand clamp was not practical, so we planned some sort of pneumatic device. The lowest bid for making two such clamps to our order was $7,000, but we solved the problem for less than 10 per cent of this cost by purchasing two second hand 50-ton bull rivet-

ers for $250 each. With flat dies in place of the conventional cup dies, they make very effective and readily removable clamps, and have solved our oxyacetylene shape-cutting problem completely.

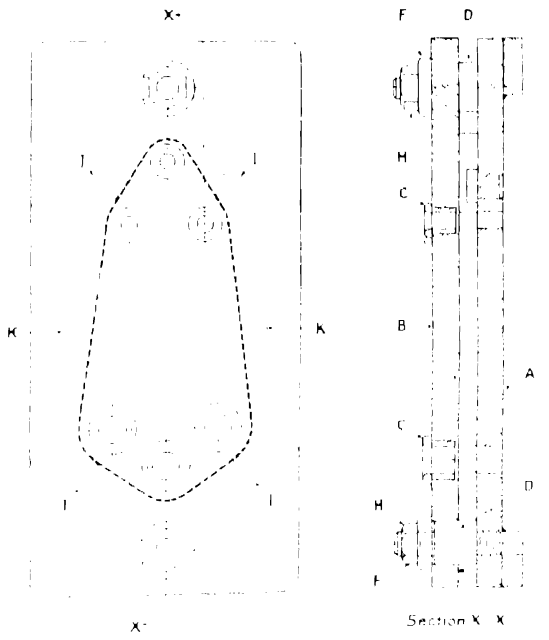
Drill Jig for Small Production

By WILLIAM B. GREFNER

The jig illustrated was designed for drilling six holes in aluminum plates indicated by heavy dashed lines in the plan view of the jig. Since the quantity of plates to be drilled was small, the jig was made as cheaply as possible.

Essentially the jig consists of the baseplate *A*; the bushing plate *B*, both of which are cold-rolled steel of commercial width and thickness; the bushings *C*; the studs *D* for locating the bushing plate; the C-washers *F*; the hex nuts *H* for clamping the bushing plate on the work; and the guide pins *I* for locating the work. Square pieces of cold-rolled steel are welded to the underside of the baseplate to serve as feet, and the baseplate is cut away at *K* on both sides to allow finger room for easy removal of the bushing plate.

In operation, with the jig open, the work is placed on the baseplate, being located by the guide pins, and the bushing plate is placed over the studs. The C-washers are then slipped into place and the nuts are tightened, holding the work securely in place. After the holes have been drilled the nuts are backed off slightly, the C-washers are slipped out and the jig plate is lifted off, the holes for the studs being large enough to permit the plate to be lifted off over the nuts.



Work to be drilled in small-quantity production will not warrant making elaborate jigs. They must be made as cheaply as possible consistent with the accuracy required

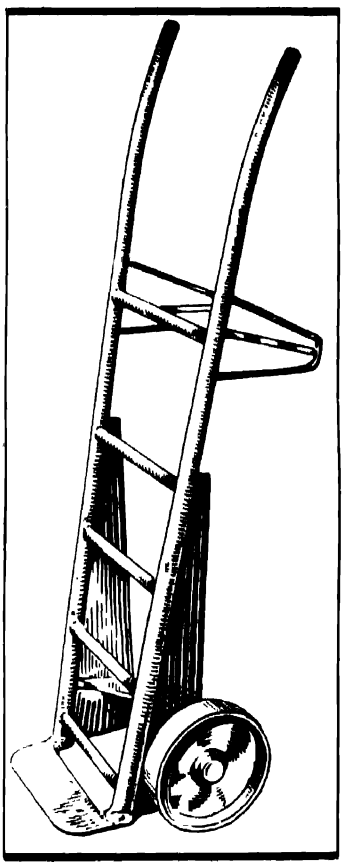
An All-Welded Hand Truck From Pipe and Plate

By ARTHUR HAVENS

Welders often make ingenious shop accessories. Take the illustrated all-welded hand truck, for instance, in which a number of novel ideas are incorporated. The handles are 5 ft. lengths of 1-in. pipe, bent slightly about 10 in. from the top end. The welder laid them on a bench 14 in. apart at the bottom and 20 in. apart at the top. Five cross pieces of ½-in. pipe were welded in at conveniently spaced intervals. The nose of the truck is simply a piece of ½x2 in. steel drawn down on one side to a sharp edge; this is welded to the bottom of the handles. Pieces of ¼ in. plate were welded to the back side of the handles to stiffen them and give the distance for wheel clearance.

Now the problem of wheels faced the welder. He cut some disks from ⅜-in. plate 9 in. in diameter and rolled ½x2 in. flat steel for tires. He cut 3x4 in. tubing into 2 in. lengths for the hubs. These were bored to take second-hand ball bearings. He welded the whole assembly into very novel wheels two bearings to each wheel. A piece of 1¼-in. staybolt iron was used for an axle. A ¼-in. hole was drilled in the center of each bearing surface, through to the center of the staybolt. Grease cups were welded into the ends of the hollow-staybolt axles.

The wheels and axles were assembled, a washer being welded on each end to hold the wheels in place. The frame of the truck was placed on the bench in its normal standing position, and after the wheel and axle assembly was placed in position, it was welded to the frame. Two ½-in. U-irons welded to the handles act as rests.



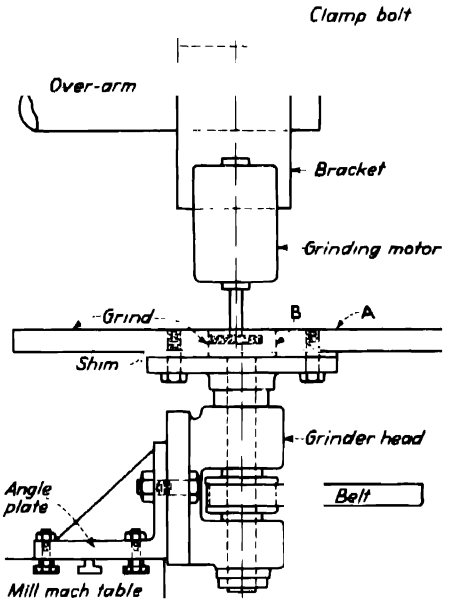
The welder who made this all-welded hand truck from scrap pipe and plate worked for a railroad in receivership. Wooden hand trucks unfit for further use were replaced at minimum cost

Grinding Large Work on a Milling Machine

By C. W. HINMAN

Recently we had a quantity of large pieces *A*, to be ground in hole *B*. The work was too large to be ground by swinging in a lathe, which had been our usual practice. The fixture illustrated was arranged to grind the holes on a milling machine.

A grinding motor was attached on a bracket, and



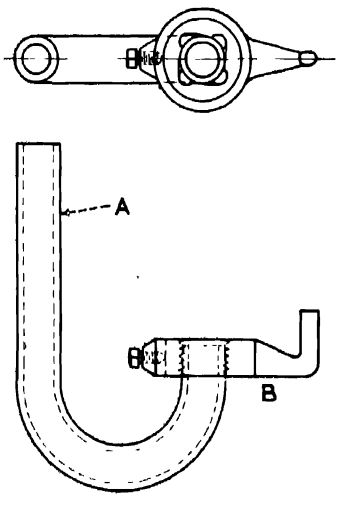
Resourceful application of grinding equipment found in most small shops permitted use of a milling machine for grinding a hole in a plate

the bracket was then clamped on the over-arm of the machine, with the motor in a vertical position. An angle plate, secured on the table of the machine, was used for mounting a belt-driven grinder head, so that the work could be revolved horizontally, as shown.

By using the lateral and vertical feeds provided with the machine, no difficulties were experienced in grinding the hole. It will be observed that this fixture could be used for face grinding the work if necessary.

When a Lathe Dog Served As A Die Holder

By C. F. FITZ



A round split die clamped in a lathe dog was used to rethread bent and plated brass pipes when the threads were cut oversize

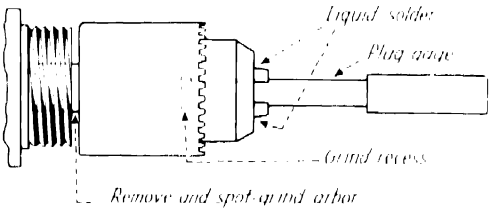
We had to make a number of brass pipes threaded and bent as shown at *A* in the drawing. They were then plated. Upon return from the plating department we found that the thickness of the plating was much more than we had allowed for and that the fittings would not fit the pipes. Since the nature of the fittings was such that we could not retap them, we were required to recut the threads.

We took a round split die of the required size and clamped it in a lathe dog as shown at *B* and rethreaded the pipes in the usual manner.

One Way to True Jaws of Small Drill Chucks

By BERNARD T. COOK

Drill chucks receive more than their share of abuse and for this reason should be reconditioned periodically. I recently trued a dozen chucks as follows: First, I removed and spot-ground all arbors to eliminate burrs and scratches and replaced the arbors in their respective bodies. Using $\frac{3}{8}$-, $\frac{11}{16}$-, and $\frac{7}{8}$-in. plug gages for $\frac{1}{2}$-, $\frac{3}{4}$-, and 1-in. chucks, respectively, the jaws were lightly closed on the gage and locked to the body with liquid solder. The solder hardens in a few minutes and after removing the plug, a recess about 0.010 in. deep is ground at the extreme back end of the jaws. The latter are then carefully ground concentric. The diameter of the internal grinding wheel should be approximately the same as that of the gage. The solder is easily scraped off once the operation is completed.

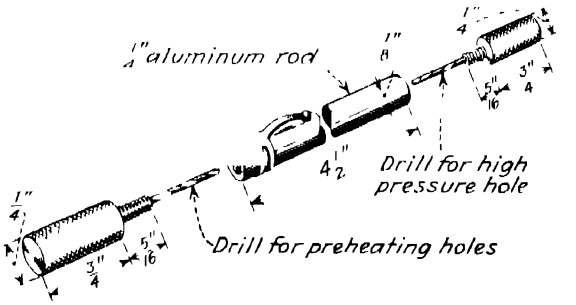


Drill-chuck jaws, centered on plug gages, can be soldered in position preparatory to grinding them concentric with the spindle

Pocket Holder for Cutting-Nozzle Drills

By A. H. CARROLL

Recently, I noticed in the pocket of a welding supervisor a neat-looking rig that resembled a pencil. Upon examination, the ends of the rig unscrewed and to them were soldered drills, just the proper size for cleaning clogged holes in oxyacetylene cutting nozzles. Carrying the drills in this convenient manner always keeps them handy and saves many trips to a work bench or tool box just when it is most aggravating to leave a job.



This $\frac{1}{4}$ in. aluminum rod with pencil clip attached has two threaded ends to which are soldered drills for cleaning holes in flame-cutting nozzles. It saves many trips to a tool box when the tips clog with flame-cut metal

Diamonds for Truing Grinding Wheels

BY LEO GLUCK

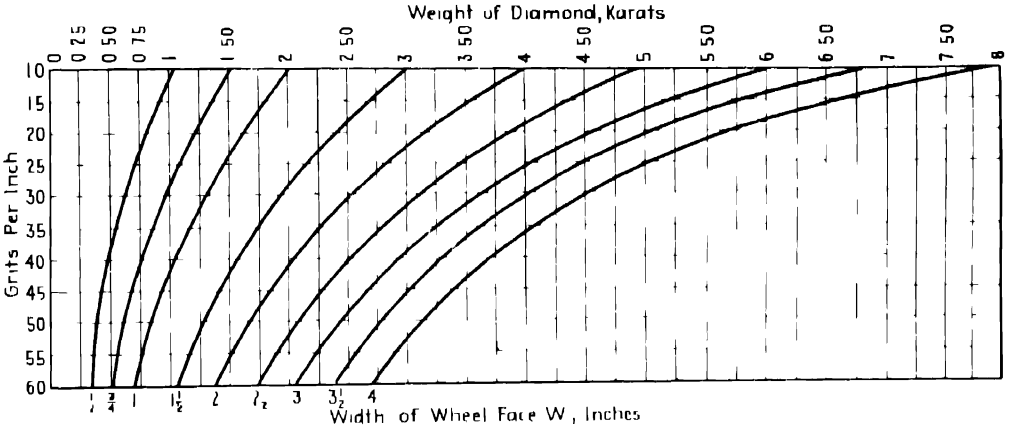
THE SIZE of grinding wheel grits and the width of the wheel face are the prime factors which control the weight of industrial diamonds used for truing the wheel. The required weight of the diamond increases in geometric ratio with the coarseness of the grits and directly with the face width of the wheel. Also with the number of wheel dressings which are required.

The unit weight of diamonds is the metric karat of 200 milligrams. The unit cost of the diamond increases in geometric ratio with the weight while its resistance to abrasion is directly proportional to its weight. Therefore for every grinding wheel or group of wheels there is an economic diamond size for truing operations. Selection of such diamond sizes can be made from either the table or drawing. Tabulated values as well as those used in drawing the curves were obtained by applying the following empirical formulas:

$$K = \frac{2400\,W}{(N_1 + 60)\,2}$$

$$K = \frac{945\,W}{(2.54N + 60)\,2}$$

where K = diamond weight in karats, W and W = face width of grinding wheel in inches and centimeters respectively, and N and N = number of grits per inch and centimeter respectively.



Knowing the face width of the grinding wheel and the grits per inch the most economical diamond size for truing operation can be obtained from this chart

ECONOMIC DIAMOND WEIGHTS FOR TRUING GRINDING WHEELS

Grit No	Grits per cm N	Grits per in N	Width of grinding wheel W, inches: 1/4	1/2	3/4	1	1 1/4	1 1/2	1 3/4	2	2 1/4	2 1/2	2 3/4	3	3 1/4	3 1/2	3 3/4	4
			Width of grinding wheel W, centimeters: 0.64	1.27	1.91	2.54	3.18	3.81	4.45	5.08	5.71	6.35	6.99	7.62	8.26	8.89	9.53	10.16
			Diamond weights, karats															
4	3.94	10	0.49	0.98	1.47	1.96	2.45	2.94	3.43	3.92	4.41	4.90	5.39	5.88	6.37	6.86	7.35	7.84
6	5.91	15	0.43	0.86	1.29	1.71	2.14	2.56	3.00	3.42	3.85	4.28	4.70	5.12	5.55	6.00	6.41	6.84
8	7.87	20	0.38	0.75	1.13	1.50	1.88	2.25	2.63	3.00	3.38	3.75	4.10	4.50	4.88	5.25	5.63	6.00
10	9.84	25	0.34	0.67	1.00	1.33	1.67	2.00	2.33	2.66	3.00	3.33	3.66	4.00	4.33	1.66	5.00	5.32
12	11.61	30	0.30	0.60	0.90	1.19	1.50	1.79	2.09	2.38	2.68	3.00	3.28	3.57	3.87	4.17	4.50	4.76
14	13.78	35	0.27	0.53	0.80	1.06	1.33	1.59	1.86	2.12	2.39	2.65	2.92	3.18	3.44	3.71	3.97	4.24
16	15.75	40	0.24	0.48	0.72	0.96	1.20	1.44	1.68	1.92	2.16	2.40	2.64	2.88	3.12	3.36	3.60	3.84
18	17.72	45	0.22	0.44	0.66	0.87	1.09	1.31	1.53	1.74	1.96	2.18	2.40	2.61	2.83	3.05	3.27	3.48
20	19.69	50	0.20	0.40	0.60	0.79	1.00	1.19	1.39	1.58	1.78	2.00	2.18	2.35	2.57	2.77	3.00	3.16
22	21.65	55	0.19	0.37	0.55	0.73	0.92	1.10	1.28	1.46	1.65	1.83	2.01	2.19	2.38	2.56	2.74	2.92
24	23.62	60	0.17	0.33	0.50	0.67	0.84	1.00	1.17	1.34	1.50	1.68	1.83	2.00	2.18	2.35	2.50	2.68

Note: Diamond weights for wheel sizes other than those given can be interpolated from the table.

STARRETT TOOLS

ARE YOU DOING THESE JOBS THE HARD WAY?

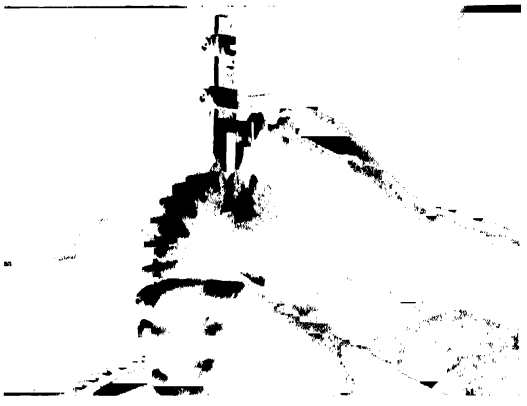


HERE'S AN EASY WAY TO HANDLE INSIDE MEASUREMENTS — 1/8 TO 6 INCHES

On work involving a number of holes, slots or grooves of different sizes, or when duplicate work must be checked for standard hole sizes, these Starrett Gages provide a quick, reliable solution. Small Hole Gages No. 829 take care of the small stuff from 1/8 to 1/2 inch. Telescoping Gages No. 229 handle the rest up to 6 inches. Both types can be set to a given size and used as plug gages or expanded to "feel" for close or loose fits and miked for size.

THE RIGHT WAY TO CHECK FOR CORRECT CUTTER CLEARANCE

On any cutter from 2" to 30" or more in diameter — end, spiral, helix, or inserted tooth — Starrett Cutter Clearance Gage No. 459 checks clearances directly and *accurately* in degrees. No need to remove cutter from grinding arbor, no fooling with protractors, etc. — saves grinding time, makes cutter work better, last longer.



GEAR TOOTH CALIPER No. 456 SAVES COMPLICATED FIGURING ON GEAR WORK

A "must" tool for work on gear teeth, gear cutters, hobs, etc. Measures both chordal thickness and addendum simultaneously — reads direct in thousandths of an inch (available also Metric by 1.50 mm.) and may be had in 20-2 or 10-1 diametral pitch.



FOR MORE TIME-SAVING IDEAS, CONSULT YOUR STARRETT CATALOG

Among the 3000 tools shown in up-to-date Starrett Catalog No. 26C are scores of new tools or familiar tools with important refinements and improvements. Look them over for ways to do more and better work. Write for a free copy.

THE L. S. STARRETT CO.
ATHOL • MASSACHUSETTS • U. S. A.

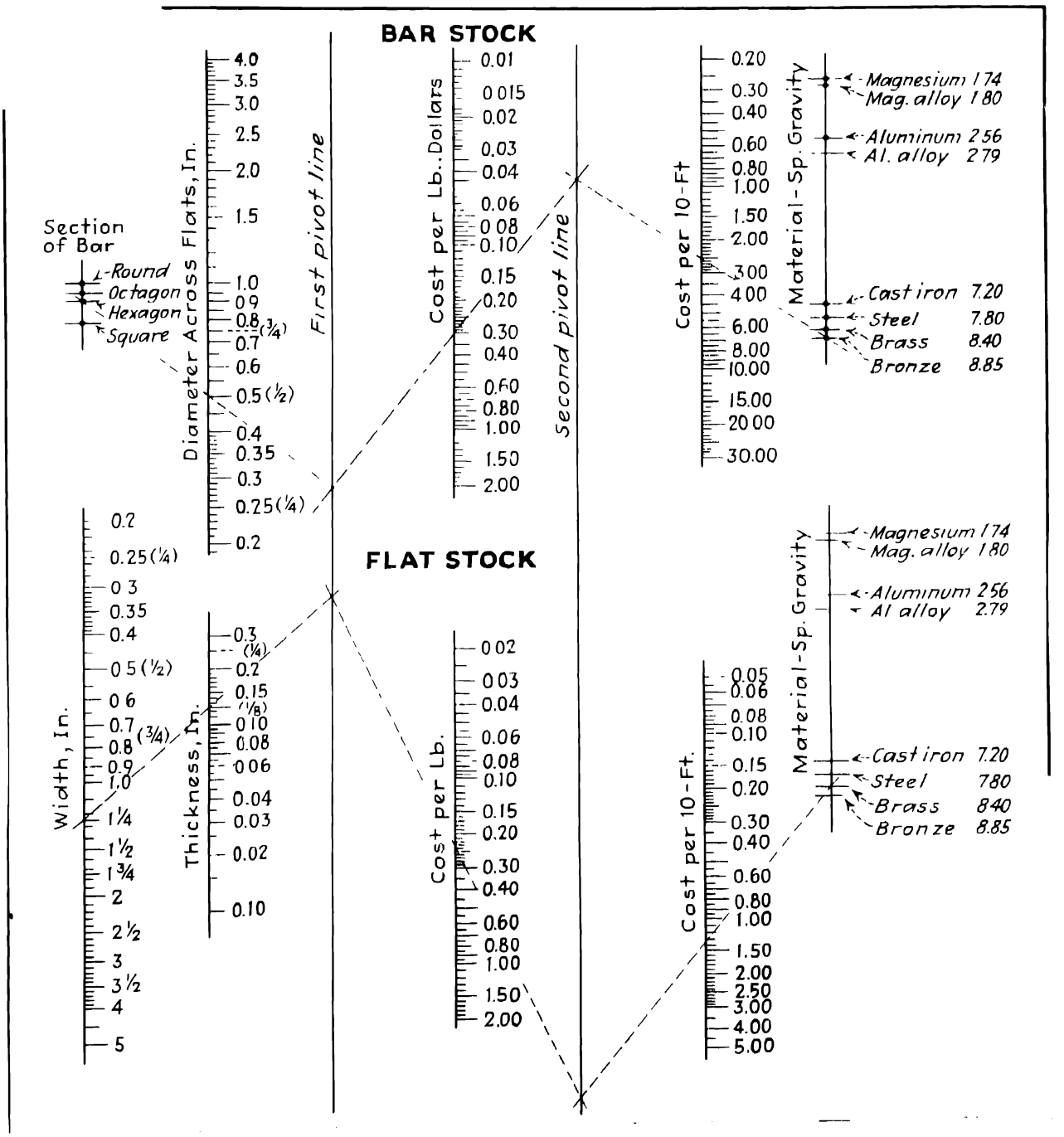
AVAILABLE THROUGH YOUR FAVORITE SUPPLY HOUSE

Charts for Cost of Flat and Bar Stock

BY LOUIS de L BERG

THESE CHARTS are for determining the cost of 10 ft lengths of flat and bar stock. In using the chart for bar stock, pass a straight line through the known section and diameter until it intersects the first pivot line. The line is continued from the first pivot line, through the cost pound of the material to the second pivot line. A line from the last point to the material from which the stock is made will give cost of bar in 10 ft lengths.

For the examples shown by dashed lines on the chart, the cost per 10 ft of ½ in. bronze hexagonal stock, quoted at 30¢ per lb., will be $2.50. A 10 ft piece of flat 1¼×⅛ in. brass, quoted at 25¢ per lb., will cost $1.30.



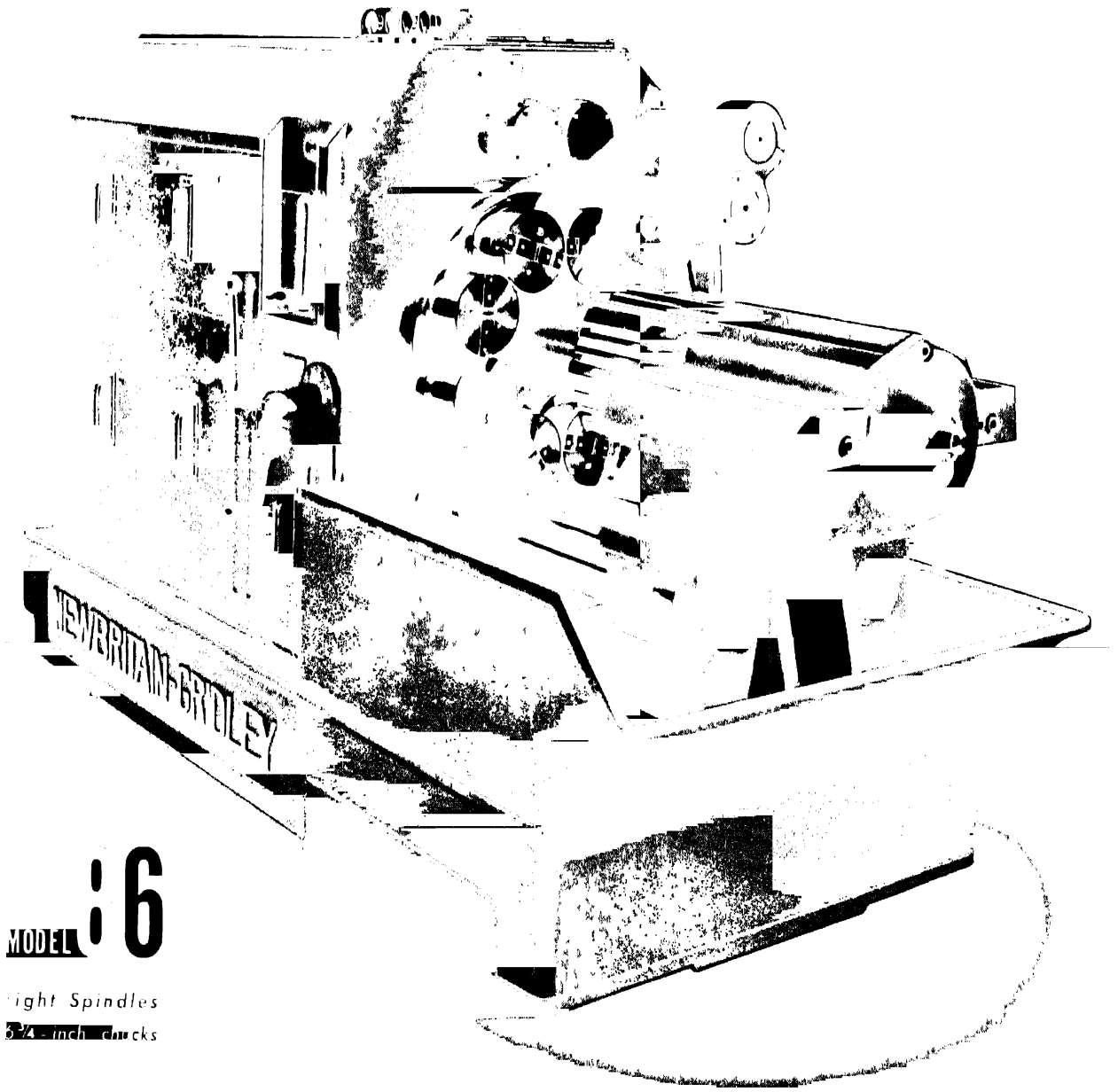
FAST AND ACCURATE

Profitable returns are assured by using NEW BRITAIN Automatics because of NEW BRITAIN'S built-in features. There is speed to meet production demands of the greatest volume, power and rigidity for the toughest cut, and precision to meet conditions requiring closest tolerances.

NEW BRITAIN-GRIDLEY MACHINE DIVISION

THE NEW BRITAIN MACHINE CO.

NEW BRITAIN, CONN.



MODEL :6

ight Spindles

3/4-inch chucks

A complete line of chuckers—four, six and eight spindles to 1½" capacity.

Wanted: "Trained Brains"

GENERAL SHERMAN MILES, assistant chief of staff of the United States Army, is speaking:

"We draw a somewhat false lesson when we say that this is the age of mechanized war. The machine does not think; even superiority in numbers of weapons promises no success unless they are handled by trained brains."

That is a plea for the training of soldiers—of plane pilots, of tank operators, of men who can fire anti-aircraft guns with speed and dexterity.

A similar plea should be made in connection with industry's part in armament production. Robots cannot run factories. They must be manned by operators familiar with their jobs.

Shortage of skilled labor, which the National Industrial Conference Board's survey shows is the most serious bottleneck in the armament program, is no sudden discovery on the part of those in Washington responsible for industrial mobilization. They have known it for months, or longer.

But they haven't been able to do more than issue milk-toast statements for fear that the C.I.O. and A.F.L. would kick up a fuss. When you start advocating wholesale training of men, you step heavily on the toes of organized labor!

And when it comes to the difficulties imposed by unions on the training of men, just thumb back to page 577 and read "Still Bewildered."

Anyway, the country finally is aroused to the need for training. A number of federal agencies are at work, cooperating with State and local groups. Individual companies are setting up apprentice systems and learner classes. That is all to the good.

What must be watched carefully is that the W.P.A., the N.Y.A., the C.C.C. and other agencies involved don't work at cross purposes. So far as we can see, there isn't much coordination. If there is any, it has been successfully hidden.

The government should make it easy instead of hard for youths and men to enroll for training. A young friend of ours wrote five weeks ago to the Army Air Corps that he wanted to become a pilot. To date he has had no acknowledgment from anybody. A newspaper reporter in Washington wandered around from one government agency to another to see what he should do if he wanted to take a machinist's training course. After three hours of being shunted around, he still was unable to secure any information.

One other point. Youngsters may be the most promising talent on which to draw for new recruits for metal-working plants, but industrialists will make a serious blunder if they pass by men 35 to 40, and possibly older. If the man of middle age is shunned or discriminated against, he will feel himself an outcast. His family and friends will be bitter too. Agitation for the government to do something to right a wrong will spring up. And a new law probably will be saddled on industry.

How much better it will be if industry will make a place within its ranks for a proportionate number of older men qualified to take training instead of confining its trainees to youngsters. In fact, some companies already are doing that. More should take up with the idea.

Burnham Finney

GAGING BUSINESS

Wright and Chrysler figure on machines for defense production. British ship U. S. machine tools to Canada. Allison is building eight engines a day. U. S. Steel secures huge munitions order

Metal-working plants face the most active period in history because of their vital role in the Defense Program. Plant expansion and retooling on a vast scale are planned and, in many cases, already under way. A skilled labor shortage is the most worrisome problem. The country is being scoured for good tool and die makers, all-round machinists, welders, pattern makers, operators of certain types of machine tools, and mechanical draftsmen.

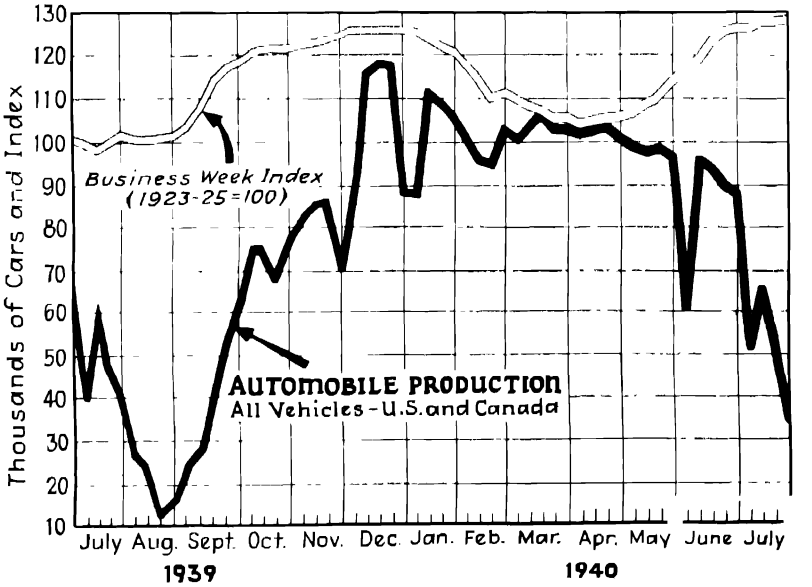
Machine Tools—New business has been large. Most of it, aside from British orders, is for the Defense Program. Pending inquiries give a clue to the tremendous bookings the next few months. Wright Aeronautical is starting to figure on equipment for its new gigantic aircraft engine plant near Cincinnati. Chrysler has been asking for prices and delivery dates on equipment for high-speed light tank production, while Packard shortly will be in the market for machinery for its Rolls Royce job. After months of inaction, the Canadian market is busy. McKinnon Industries, John Inglis, Ford of Canada and a number of plants in and around Toronto and Montreal are taking on munitions contracts. Many machine tools required for this work are being sent to Canada instead of to England by the British Purchasing Commission as U. S. builders make deliveries on orders. The British also are assigning American machine tools to Australia where a munitions industry is being built up as rapidly as possible. The Netherlands East Indies, erecting armament plants to supply their own defense needs, are purchasing machine tools here. Manufacture of big machine tools for the Navy is being accelerated by resort to several practices, such as negotiated contracts, inspection of the machines on the floor of the user instead of in the builder's plants, and pooling of the facilities of the builders. The industry has increased its plant capacity 25 per cent since last September, according to a reliable check-up. Reports are heard in the industry of serious delays in securing licenses for machines destined for export. It is said authoritatively, however, that less than five per cent of the export license applications are being disallowed.

Railroad Equipment—Orders for almost 5,000 freight cars have been placed the past two weeks. Illinois Central has contracted for 3,000 cars, buying 1,000 each from Pullman-Standard and General American Transportation and 500 each from American Car & Foundry and Mount Vernon Car. Norfolk and Western will take 500 cars from Ralston Steel Car. Five of thirteen diesel-electric switching locomotives for Reading went to Baldwin. The Baltimore & Ohio has purchased 25 diesel-electric switchers from Electro-Motive Corp. Union Pacific is in the market for 16 steam locomotives. In addition to its locomotive-building business the Electro-Motive Corp. is rough machining forgings for Allison Aircraft engines.

Steel—Though the industry is running at over 90 per cent, full effect of defense orders will not be felt for months. No one knows what the ultimate tonnage will be. Companies already are conscious of the "push" for alloy steels, and are installing more electric melting furnaces to increase capacity for defense purposes. It is believed in steel circles that present facilities, rounded out a bit here and there, will be adequate without building many new plants. Steps are being taken to expand armor plate producing and fabricating capacities.

Aircraft—Agreement of airplane builders to sign government contracts immediately instead of waiting for plant write-off legislation to be passed has cleared the road for huge plant expansions. Notable among the increases will be those of Douglas and Glen Martin. Biggest bottleneck still is in aircraft engine production. The RFC has approved a loan of $92,000,000 to Wright Aeronautical to build a plant near Cincinnati to turn out 12,000 motors a year. Allison is making six to eight liquid-cooled engines a day and expects within 30 to 60 days to be up to its present plant capacity of 20 motors a day. Any further increase of Allison's capacity is contingent on new government contracts. Ford is reported considering manufacture of the French Hispana-Suiza motor. U. S. plane production in August will be 900 to 1,000 planes.

Munitions—The United States Steel Corp. has been awarded a contract for $27,583,000 for projectiles, explosive and ammunition parts which will be filled by its subsidiary, National Tube Co. Large orders have been placed by the Army for such products as shell, cartridge cases, gun carriages, shell forgings and machine guns. It will take months, however, for industry to tool up for many of these jobs. Production will not be under way on a sizable scale until the early part of 1941.



United States to Take Training Planes While Great Britain Gets Combat Ships

Solution seen to aircraft allocation problem; shortage of liquid-cooled engines slows production of pursuit planes

WASHINGTON—Vast expansion of this country's air force, particularly as contemplated in the pending $5,000,000,000 appropriation, raises anew the problem of allocation of airplane production as between this country and Britain. Knudsen, of the defense commission, Morgenthau, and Purvis of the British Purchasing Commission have been holding a series of conferences on the subject. It is not publicly admitted, but the decision has been reached that most of the actual combat planes will still go abroad, while we will hang on to the training planes. This fits in with our present need, which is to train a big pilot force while capacity for big air fleets is built up. Of August production, 236 planes have been allocated to the British, while this country will take 396—largely trainers. Other countries will take 84, which includes deliveries to Norway going to swell the British air forces. Large commercial planes round out a scheduled 900-ship production for August—which might reach 1,000 with luck. Present plans contemplate that production will reach the 3,000-month level the middle of 1942.

Grandiloquent British announcements that they will be taking delivery here of 3,000 planes a month by next January are completely discounted here and assumed to be for home consumption. Purvis did ask Knudsen to estimate the plant investment that would be required to superimpose such a production on present schedules and was told that 38 factories would have to be built. It is estimated that this would cost in the neighborhood of $1,000,000,000. Chief significance of the British proposal is that it shows they are not going to ride along on U.S-stimulated plant expansion but will continue to put their own money into plants. Meanwhile, underwriting of their orders by big domestic appropriations simplifies their problems.

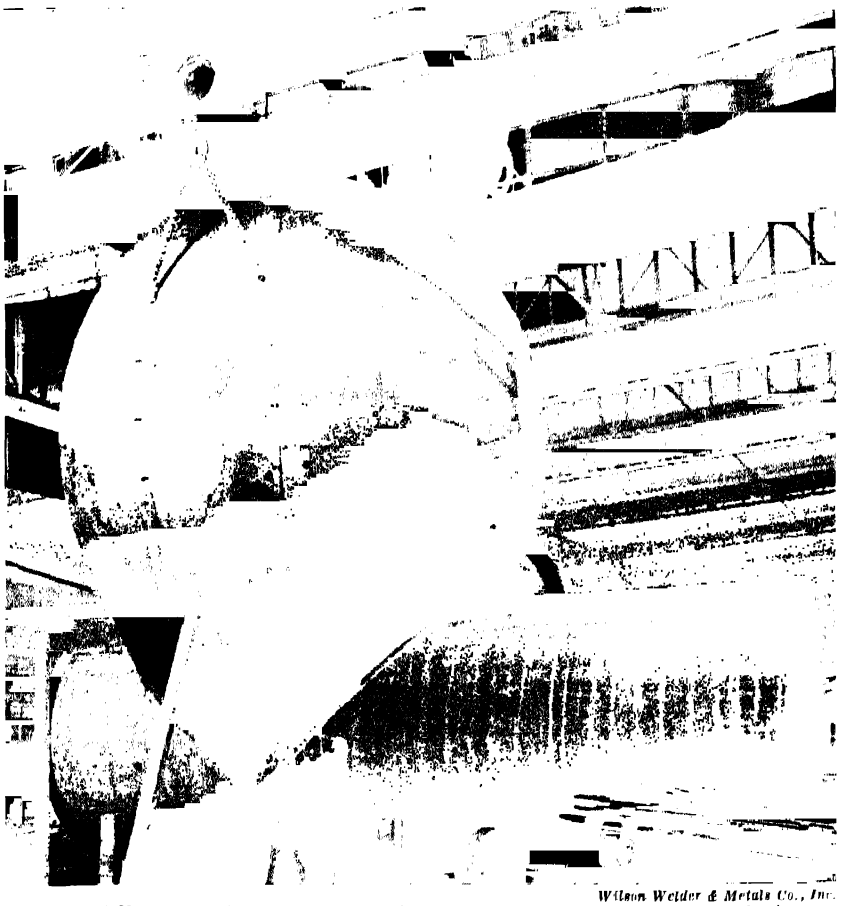
The vital problem of getting enough liquid-cooled engines to power pursuit airplanes is still troublesome. But through personnel changes, elimination of experimentation, and probably some liberalization of specifications it is hoped to improve the situation. July production of Allison engines is about 65, while it is hoped to turn out 130 in August and to reach 400 a month by November. The Rolls-Royce Packard will not be in production for at least ten months. Meanwhile Curtiss P-40s are standing in the yards waiting for engines.

FORD MAY BUILD FRENCH MOTOR

NEW YORK—Ford Motor Co. is reliably reported to be considering the manufacture at Dearborn of the Hispana-Suiza liquid-cooled aircraft engine. It is known that a Hispana-Suiza motor was recently brought to this country consigned to Ford and was hurriedly moved by truck from New York to Detroit. It is believed that this motor is now being closely studied by Ford officials. Ford, partly through its French organization, has had intimate relations with Hispana-Suiza for some time, and at one time was believed preparing to build the Hispana-Suiza motor at its French plant.

Johnson Resignation Not Result Of Petty Policy Differences

WASHINGTON—Resignation of Louis Johnson as assistant secretary of war is seen here as primarily a matter of personalities. No important policy differences are thought to have existed. Johnson, an advocate of business control of defense, was unpopular with the left wing, but the New Dealers are in abeyance for the present, as regards defense, and could hardly have forced him out. Point is that Johnson, an ambitious and energetic man, had been passed over twice for the secretaryship. First time this happened it resulted in a feud between him and Woodring that split the department into cliques for years. After Woodring quit, numbers of officers identified as Woodring men had swung over to the assistant secretary. Continuation of Johnson would have resulted in an impossible situation for Secretary Stimson. Roosevelt's offer of a post on his personal staff was doubtless sincere, but it is doubted that Johnson will accept.



Wilson Welder & Metals Co., Inc.

Arc Welding—*This novel appearing structure shows how far designers are able to go in arc welded fabrications involving complex assemblies of curved shapes. Eighteen pieces were required for the sphere while all plate material in the cylinders have a 3/8-inch wall thickness*

Buick Increases Capacity 15 Per Cent; Moves to Handle National Defense Work

DETROIT—Harlow H. Curtice, president and general manager of Buick, revealed that completion of a major expansion and retooling program will boost productive capacity to 1,500 cars per day, or 350,000 annually, against a capacity during the model run just ended of approximately 1,300 per day.

The expansion program will permit Buick to cope with increased market requirements for cars in 1941 and at the same time care for national defense needs. In connection with the latter, Mr. Curtice revealed that Buick engineers have been working with the army upon projects intended to adapt the valve-in-head motor to military uses. And other armament production has been considered. Arms manufacture would be collateral with the industry's duty to maintain normal operations and employment in automobile production

Major construction projects completed for the 1941 season include construction of a large addition to the sheet metal plant and rearrangement of machinery, a new axle plant, removal of gear manufacture to a new building and a new layout for production of connecting rods.

Predicts 10 Per Cent Gain

Mr. Curtice expressed confidence in the business outlook, estimating 1941 as a probable 10 per cent increase for the industry. Buick output for the 1940 season consisted of 283,204 cars, an all-time high. More than 15,800 employees worked an average of 2,050 hours each. Employment for the changeover season his held consistently above 9,000, and the changeover to new model production will be one of the shortest on record. Buick will hold its press preview for new lines on August 13.

CANADIAN LATHE FIRM STARTED

VANCOUVER—A contract valued at $300,000 for 100 shell lathes has been awarded to a new company being organized at Vancouver, B. C., by the Federal Government. Six prominent Vancouver businessmen are backing the new venture. The company will not erect its own plant, but will distribute the lathe manufacture amongst a number of existing machine shops located in Vancouver.

The 100 shell-making lathes are to be ready within four months. It is also reported, although official confirmation is now lacking, that following construction of the lathe munition production will be started in Vancouver by the new company.

U. S. Government Contracts Awarded to Tool Makers

(Defense Contracts on Page 590)

Contractor	Gov't Agency	Commodity	Amount
Swind Machinery Co., Philadelphia, Pa	Navy	Power shear	$18,874
Lloyd & Arms, Inc., Philadelphia, Pa	Navy	Honing machine, lathes	34,040
Hydraulic Press Mfg. Co., Mount Gilead, Ohio	War	Hydraulic press	17,310
National Acme Co., Cleveland, Ohio	War	Automatic machines	35,996
Vandyck Churchill Co., Philadelphia, Pa.	War	Milling machines	13,668
W. E. Shipley Machinery Co., Philadelphia, Pa.	War	Shapers	10,630
Henry Prentiss & Co., New York, N. Y.	War	Grinding machine	10,435
Gisholt Machine Co., Madison, Wis	War	Lathes	14,477
C. H. Gosiger Machinery Co., Dayton, Ohio	War	Lathes, drill presses	37,328
H. R. Krueger & Co., Detroit, Mich	War	Reaming machine	14,623
Cyril Bath & Co., Cleveland, Ohio	Justice	Press brakes	11,475
Cincinnati Milling Machine Co., Cincinnati, Ohio	War	Milling machines	152,670
Toledo Machine & Tool Div., E. W. Bliss Co., Toledo, Ohio	War	Presses	21,651
Brown & Sharpe Mfg. Co., Providence, R. I.	War	Milling machines	91,351
G. A. Gray Co., Cincinnati, Ohio	War	Planer	21,040
Gleason Works, Rochester, N. Y.	War	Gear cutting machine	17,984
Kearney & Trecker Corp., Milwaukee, Wis	War, Agriculture	Threading machines, Millers	64,859
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn	War	Toolroom machine	13,715
Monarch Machine Tool Co., Sidney, Ohio	Navy	Lathes	54,681
E. A. Kinsey Co., Cincinnati, Ohio	Air Corps	Milling machines	25,917
New Britain-Gridley Machine Div., New Britain Machine Co., New Britain, Conn	War	Chucking machine	77,880
Sundstrand Machine Tool Co., Rockford, Ill.	War	Automatic machines	10,782
Bodine Corp., Bridgeport, Conn	War	Reaming machine	10,480
Steacy-Schmidt Mfg. Co., York, Pa	War	Crimping machines	12,150
Yates-American Machine Co., Beloit, Wis	War	Borers	56,712
Norton Co., Worcester, Mass	War	Grinders	48,027
Seifreat-Elstad Machinery Co., Dayton, Ohio	War	Honing machines	258,632
H. R. Krueger & Co., Detroit, Mich	War	Broaching machine	15,095
Stedfast & Roulston, Inc., Boston, Mass	War	Rebuilding machines	23,841

ALL IDEAS WELCOME

WASHINGTON—The scientist in his cellar laboratory comes into his own in the defense program. Harry Hopkins has appointed a National Inventors' Council, headed by Charles F. Kettering of G.M., to examine ideas on defense, screwball and otherwise, submitted by the civil population. Commissioner of Patents Conway P. Coe will maintain liaison between the council and the recently appointed Defense Research Committee.

Export License Exemptions Announced by State Dep't.

The Division of Controls of the Department of State, Washington, D. C., has indicated that export licenses are not required for the following items:

- All used or rebuilt machine tools of any description
- Pipe threading machines
- Metal cutting band saws
- Power driven hack saws
- Keyseating machines
- Disc grinding machines
- Car wheel & locomotive wheel presses
- Burring, Chamfering, Burnishing gear machines
- Planers—crank
- Bench power presses
- Saw sharpening machines
- Filing machines
- Pipe bending machines
- Thread chaser grinders
- Burnishing machines
- Tool & cutter grinders—universal and plain-hand feed
- Riveting machines
- Grinding machines—portable, with flexible shaft
- Centering machines
- Grinders—face milling cutter
- Arbor presses—hand, air and hydraulic
- Grinding machines—drill, tap, hob
- Nibbling machines
- Grinders—lathe tool
- Gear tapping machines
- Gear shaving machines
- Polishing machines
- Heat treating furnaces
- Foundry machines
- Portable tools driven by fractional horsepower motors or by compressed air
- Blocks, rolls, shears, small punches, if hand operated.
- Repair parts for machine tools other than important sub-assemblies, in quantities not sufficient to constitute a substantially complete metal working machine of the character mentioned by the President's proclamation of June 2nd, in unassembled form.

Warner & Swasey Plans to Offer Its Stock to Public

CLEVELAND — If stockholders approve August 20, the Warner & Swasey Co. will become a corporation with a substantial public ownership. The company will be recapitalized and a public market provided for its closely held securities.

The plant is to increase the common stock from an authorized 300,000 shares of $5 par value to 1,000,000 shares without par value and to change each share of $5 par value common stock into three new shares without par value. At present 248,245 shares of $5 par value common stock are outstanding.

The heirs or estates of Worcester Reed Warner and Ambrose Swasey, who founded the company, plan to dispose of a part of their holdings largely for tax reasons or for purposes of diversification. The company expects to register these shares of common stock and certain shares which the company may wish to sell with the Securities and Exchange Commission. The management feels it would be beneficial if outstanding shares were more widely distributed so as to establish a broader market for the company's securities. Stock distribution will be through a group headed by Smith Barney & Co

Six per cent cumulative preferred stock, totaling 13,502 shares of $100 par value, will be retired, if the program goes through, either through redemption or through an exchange of common stock.

Charles J. Stilwell, president, and other senior officers identified with the company for more than 20 years will continue responsible for the management.

INDUSTRIAL TRAINING PROGRAM MEETS WITH CRITICISM ON DELAY

WASHINGTON—The much publicized plans for the training of thousands of men in the skilled trades are meeting many difficulties. Some observers indicate that the opposition to training in plants is not coming from labor as much as it is from industry. The latter simply cannot dilute productive processes by taking on trainees on the scope contemplated.

The National Youth Administration plans for vocational training in hand skills is making a concrete approach through the establishment of training shops to familiarize young men with factory work and prepare them to enter industry. Industrial experts may fit in as instructors in night-school training programs.

Meanwhile other observers indicate that the entire training program will take months to shake down to any sort of efficiency.



From Furnace to Tank—*A crane grapple delivers a load of bars to an 18,000 gallon quenching tank after being treated in a bell-type heat treating furnace. In the tank the bars are cooled to the required temperature before removal to a Brinell testing bed for physical tests*

Aircraft Companies Will Sign Defense Contracts, Profit Limitations Notwithstanding

WASHINGTON—To avoid defense production delays representatives of major aircraft companies, headed by Donald W. Douglas, have agreed to sign contracts immediately instead of holding them up until legislation regarding profit limitation and amortization rates is enacted. Plane manufacturers have been advocating a write-off in five to eight years of depreciation for tax purposes as a safeguard in plant expansion for defense.

"This action by the industry," says Mr. Douglas, "will cut much red tape while necessary laws are being passed and make possible immediate start toward the huge expansion so vitally needed. Manufacturers feel that speed and production are the paramount issues."

Plane makers have been in conference with the Army, Navy and Defense Advisory Commission. Recently the Treasury Department issued a statement approving the write-off in eight years of new factories and equipment designed solely for defense purposes. Congressional legislation will soon be introduced to permit amortization in five years.

Plane contracts cleared by the National Defense Advisory Commission include $900,378 for Cessna Aircraft, $2,074,070 for Ryan Aeronautical, $16,361,342 for Consolidated Aircraft, $993,844 for Fairchild Engine & Airplane, $7,562,834 for Aviation Mfg., $3,510,746 for Beech Aircraft, $5,713,389 for Stearman Aircraft, and $33,913,296 for Boeing Aircraft, and $1,859,880 for Spartan Aircraft. Plane engine contracts have been cleared in the following amounts: $1,488,272 for Wright Aeronautical, $5,489,308 for Ranger Aircraft, $1,541,448 for Lycoming Division of Aviation Mfg.

MORE DEFENSE CONTRACTS CLEARED

WASHINGTON — Army and Navy contracts amounting to $1,650,000,000 were cleared by the National Defense Advisory Commission's production division, under William S. Knudsen, from June 6 to July 17.

Among the contracts not already reported in AMERICAN MACHINIST are the following: $5,661,600 to the Springfield armory for Garand rifles, $4,573,628 to Sperry Gyroscope Co. for equipment, $7,700,000 to the Watervliet arsenal for artillery guns, $11,496,951 to American Car & Foundry Co for tanks, $5,387,500 to White Motor Co. for scout cars, $877,723 to Auto Ordnance Corp. for rifles, $732,000 to R. Hoe & Co. for recoil systems for anti-aircraft guns, $1,757,083 to Vickers, Inc., for gun turret equipment, $1,797,536 to Northern Pump Co. for gun turret equipment, $16,055,415 to Picatinny arsenal for ammunition and bombs, $535,074 to Erie Forge Co. for breech house forgings, $549,500 to Crucible Steel Co. for gun barrel forgings.

TAKE ORDERS AT LOCAL OFFICES

WASHINGTON—There is no need for most manufacturers to go to Washington for orders. The Army and Navy will buy machinery and equipment through local procurement offices.

Canada Boosts Production of Munitions; Plants, Planes Receive Most Attention

MONTREAL—On the assumptions that Hitler's blitzkrieg will fail, that Britain will continue to control the sea and effectively blockade the continent—Canada's war efforts are being concentrated in two directions.

Firstly, to quickly produce as many essential war materials as possible and which are vital to Britain in repelling an invasion. Such materials include aircraft, anti-tank and anti-aircraft shells, and munitions of all kinds. To assure the rapid production of such war materials, government control is being exerted over machine tools, raw materials, transportation, and exports.

Secondly, To develop war industries, which will be able to produce vast quantities of chemicals, munitions, and armament of all classes for an offensive. In this connection total war contracts in Canada exceed $400,000,000 to date, and some observers indicate that new orders worth $200,000,000 are likely to be placed shortly. New commitments for capital outlays to provide facilities for Canadian production are expected from the British and Canadian governments.

The most recent plant commitments include the following: a $9,000,000 plant for the manufacture of chemicals; an $8,000,000 shell-filling plant to be managed by Canadian Car & Foundry Co.; and 13 plants to be built at a cost of $20,000,000 to $31,000,000.

Ford and General Motors are spending several million dollars in adding to existing plant capacity so that carriers for guns and other armament equipment may be produced. Plant additions (excluding entirely new plants) already financed by Britain and Canada will exceed $80,000,000 when completed.

The Canadian Pacific Ry. Angus shops in Montreal have begun production of tanks at a planned rate of 30 a month. British and Canadian orders for them total $63,000,000. Meanwhile thirty-four Canadian shipyards are ahead of the construction schedule in the $60,000,000 navy program.

The Bren gun plant will be doubled. A $400,000 addition will permit the construction of bipods, formerly manufactured in England, for the Bren guns. Meanwhile the Canadian General Electric Co. has started a $1,000,000 addition to its Peterborough plant. The Citadel Merchandising Co., formed six weeks ago, has already bought over $15,000,000 of machine tools. Factories under construction are valued at $120,000,000 at present. This is scheduled to add $500,000,000 yearly to Canada's productive effort.

MONTREAL—At least 1,500 planes are to be built in Canada this year. Next year the schedule calls for 2,400. In a short time Canadian production should provide airplanes at the rate of 200 a month.

The increased produce of fighting planes has been helped by the step-up in the Canadian production of elementary training aircraft which are being used as a part of the Empire pilot training scheme in Canada. Although original contracts called for deliveries up to the end of next year, the accelerated building program calls for deliveries to be completed by the end of 1940. To date more than 20 percent of the original 808 training planes ordered have been delivered.

Although the manufacture of Bristol bombers and Hurricanes has also been increased, future production will emphasize output of American type planes. Arrangements have already been made for the importation of engines and parts from the United States, and plans for future production are of design, material and equipment available on this continent. This will enable manufacturers to fill specifications which are in no way dependent on Britain. Canadian Associated Aircraft will begin mass production at once.

About 12,000 men are now employed in aircraft production in Canada and many more are to be added soon. This month five additional flying schools were started which puts the present air training program about three months or a year ahead of the original schedule.

Tanks to Use Radial Diesels Manufactured by Buda Company

WASHINGTON—Guiberson radial (air-cooled) diesel engines, of which the Army has just ordered 500 at a cost of $2,915,255, will be used to power tanks. Army tanks for some years have used radial engines exclusively, but this order brings the diesel engine for tanks out of the experimental stage for the first time. It also sets up the potentiality of a policy conflict, since other quarters in the administration are dead set against any military reliance on diesels—pointing to less adequate distribution of diesel fuel and comparative scarcity of good diesel mechanics.

The Guibersons will be built under license by the Buda Co., which is expanding its Harvey, Ill., plant to attain a production of eight to ten engines a day.

DEFENSE CONTRACTS SOAR

WASHINGTON—Both the War and Navy Departments hit the ceiling this week when the defense commission released a long list of contracts totaling $1,650,000,000, reported as having "cleared." The inference is that the defense program is going ahead great guns. However, some contracts may not be signed until plants are amortized.

Auto Plants Cannot be Converted Quickly to Armament Manufacture

DETROIT—"A popular American belief is that automotive industries in the U.S. can easily be converted overnight to aircraft and armament production. But this is not true!"

So exploded A. G. Wickman, president of A. G. Wickman, Ltd., leading British machinery concern, and also president of the British Hard Metal Association.

According to Mr. Wickman, much of Great Britain's industrial equipment for the production of automobiles, etc., cannot be used for the manufacture of shells, aircraft, or aircraft engines. In the U.S. Mr. Wickman believes that automobile manufacturing equipment in war time can be used only for the production of ambulances, trucks, and vehicles of a similar nature.

"The rapid pick-up in British armament production is due," Mr. Wickman feels, "to the increased availability of carbide cutting tools." As both German and English machine tool manufacturers use carbide 100 percent, Wickman is surprised that the U.S. does not use carbide tools more extensively. The modernization of many smaller industries in the U.S. lags far behind that of Great Britain and Wickman thinks that particular attention should be paid to the production of accurate shell forgings.

In this connection a 1940 Inventory made by AMERICAN MACHINIST revealed that not more than 30 to 40 percent of Britain's industrial machinery is over ten years old. This is to be compared with an estimated 70 percent or more in the U.S.

Another factor is "chip control". For example, Wickman indicates that if older types of shell turning lathes in the U.S. were operated at the speeds used in Britain, the machine and operator would be buried under chips in short order. He concludes with the observation that production is a chain of events and that it is useless to coordinate the most modern turning methods with other antiquated links in the production chain, as those will only pull down the efficiency of the whole production line.

INSIDE DETROIT

Interior decoration of 1941 cars will depend more upon an expanded use of thermoplastics. Industry is interested in molding equipment; sees several changes in production practice

BY RUPERT LE GRAND, DETROIT EDITOR

DETROIT—Richer interior decoration of 1941 cars will depend in a large degree upon expanded use of thermoplastics. As compared with current models, Ford, Chrysler, Hudson and Packard are expected to raise consumption of these materials by as much as 30 percent. The additional weight per car is not great, being only a pound or so Plastic goes a long way, as evidenced by the fact that an instrument panel insert 28½ in. long weighs approximately 10 oz.

Consumption of thermosetting plastics is expected to be approximately the same in weight as for 1940 models. Phenolic compounds are used mainly for non-decorative purposes, such as for electrical parts and others hidden from view. On the other hand, thermoplastics, usually cellulose derivatives, lend themselves to colorful applications. Brighter colors and better color harmony of car interiors are watchwords in design of 1941 models, hence more lavish use of plastics upon the instrument board, window valances, garnish-molding inserts, and hardware.

Considerable interest in molding equipment was displayed earlier in the year. It seemed for a time that more automobile manufacturers would set up their own molding facilities because consumption on some models runs into several hundred thousands of pounds of plastic materials per year. But interest faded, either because of national defense plans, or because jobbing shops can supply molded parts at lower cost. Yet Chrysler has added to its molding equipment, and Ford has made arrangements to increase daily output by 50 per cent.

Ford's plastic molding division has been moved from the glass plant to the tire plant, where it occupies a space measuring 90x250 ft. at one end of the building. Four production lines are laid out along the 250-ft. dimension. Line No. 1 is devoted to machining and finishing parts molded from thermo-setting soy-bean materials. Line No. 2 consists of sixteen injection molding machines for thermoplastics. Line No. 3 is utilized for machining and assembling thermoplastics and Line No. 4 includes platen-type molding machines for thermosetting plastics. Approximately 450 men are employed during the height of the season.

Molding equipment has not been increased, but new methods will permit manufacture of 250,000 pieces per day for 1941 models, as compared with 165,000 pieces during the season now ended. New parts will also be handled—25 additional items in thermoplastic and 6 in soy-bean plastic, making a total of 97 thermoplastic and 30 soy-bean plastic items The step-up in production is to be brought about by the following changes in practice

Production Methods Change

1 Molding of inserts will be avoided so far as possible. Instead, inserts will be bench assembled. Output of the injection molding machines will be doubled or tripled because open mold time will be sharply reduced.

2. Simplification of items. One knob, for example, will be used in several additional ways, by application of suitable pressed-in connections. One mold will make five knobs at once or 20,000 per day. Or other parts can be made with a low-production knob.

3. Cam molds are being eliminated wherever possible. In some cases, cores are being operated by hydraulic cylinders In others, the parts has been redesigned. For example, a knob with a collar is now to be made in two pieces There will be no mold parting line to finish Placing a touch of cement on the collar and pressing it onto a shoulder on the knob simplifies and speeds up production.

4. Lettering is not being molded into the part Instead, part numbers and other information are being applied by decalcomania transfers Or, a light switch will be made of clear plastic and covered with a metal cap with the letter L perforated therein. Illumination through the cap will add a new decorative touch, permit finding the knob more easily.

Since inserts will be avoided in the molding process, other means must be utilized for fastening metallic parts firmly to plastic pieces Pressing is the logical method. Technique has been worked out so that a pull of several hundred pounds, or more than will be encountered in service, must be exerted to separate the assembled components

FISHER MAY BUILD AIRCRAFT

DETROIT—Fred J. Fisher, a founder of Fisher body, is reported to have made an agreement with William B. Stout, whereby ample production facilities will be provided for building the latter's stainless-steel, training type airplane. Eventually mass production methods are expected to reduce the cost of each ship to $1,000. To complete and license the model may take six months, after which a new plant will be built



Automatic Snagging *-Part of Pontiac's $1,000,000 renovation program for 1941 consists of this automatic top-and-bottom grinder for cylinder blocks Machine saves on wheel cost and labor compared with hand swingframe grinding; removes fins only*



High Speed Photo—*In 30,000th of one second the action of a gear cutter generating a bevel drive pinion gear was caught on a photographic plate The oil which to the naked eye covers the entire gear and grinding teeth appears as a solid frozen sheet to the camera lens*

Because of the small size of thermoplastic parts it is desirable to perform all machining and assembly operations upon benches For this reason the plastic molding division asked the Ford tool design department to design presses and drills of Lilliputian size approximately 2 ft high These units are faithful replicas of high-class full-size machines occupy little space on the bench and afford maximum handling ease and utility Fixtures are readily changed and every safety precaution is incorporated

Assembly benches are connected to the injection molding machines by chutes The machine operator tosses inspected pieces into the chute leading to the assembly bench throws scrap and sprues down another chute leading into an inclosed belt conveyor running to the compound regrinding department One bench operator may easily keep pace in some cases, with the output of two injection molding machines

Symphonic Styling

Hudson's bid for sales in 1941 is centered about pleasing women buyers through an advanced development in color harmony "Symphonic Styling", as it is called, offers at no extra cost a selection of interior color combinations that harmonize with exterior body color Up to now one upholstery color has usually done duty with every body color

Symphonic Styling offers three interior combinations—grey green and tan—the one selected being determined by the exterior color For example, if tan is the basic color harmony selected, the exterior body color and the unholstery, headlining trim, carpets, floor mats and instrument panel will be in harmonizing shades of tan Hudson is able to take this forward step in color harmony because factory operations have always been kept flexible, to build cars to customer's option not for dealer stocks

Hudson's three new lines on 116 121 and 128 in wheelbases offer engines from 92-128 hp New "torpedo type" styling has increased the body length 5½ in, lowered the body height by 2 in, and increased luggage space 25 per cent Wheelbases are longer. New models were seen at a private showing on July 19 It is likely that Hudson will again beat the field for new-model announcement, but others are close behind this year

Warner Aircraft

An order for 250 engines and spare parts for training ships has been placed with the Warner Aircraft Corp, Detroit, by the British Purchasing Commission, acting for the Australian government These are current-model engines and production is being fitted into the larger production bank for domestic purposes Delivery will be completed by early spring

No expansion of the plant will be required because of the British order and none is foreseeable on account of expanded purchases from government sources The government is not expected to go hog-wild on procurement of training ships and it is likely that Warner and its competitors can handle the engine business with present facilities Warner stands a good chance of getting procurement orders because it builds engines from 125–165 hp The Civil Aeronautics Authority is reported favorably inclined toward the 125 hp model while the Army and Navy are considering the use of smaller engines in training ships thereby permitting purchase of the 165 hp model

Equipment vendors have been busy quoting prices to as many as ten sources for equipment to make 50 caliber and aircraft machine guns Evidently the government wants bids from a number of sources in order to balance all the factors involved before letting contracts

1940 PRODUCTION ENDS

DETROIT—With Chevrolet production decreased during the week of July 22 and Ford planning to drop current models this week assembly of 1940 cars is at an end Most other manufacturers discontinued current models at the end of June or during the first or second weeks of July By mid-month Hudson was shipping 1941 lines to dealers and Packard last week was in operation again First press preview will be held by Buick on August 13, when reporters will be given a chance to drive cars with new performance characteristics in view of higher octane fuels available this fall

Associated Machine Tool Dealers In Convention at Dayton, Ohio

The Associated Machine Tool Dealers of America will hold their annual convention Oct 21, and 22 at Dayton Ohio

Among the members of the program committee are the following George E Young and C H Gosiger of C H Gosiger Machinery Co, J W Barbour, E A Kinsey Co, Inc, and E J Seifreat Seifreat-Elstead Machinery Co All are from Dayton Ohio

W J Radcliffe and E B Andrews of E A Kinsey Co, Inc, E C Elstad, Seifreat-Elstad Machinery Co; and E A Shiver Motch & Merryweather Machinery Co All are from Cincinnati, Ohio

WATCHING WASHINGTON

Tentative priorities division set up in the Army and Navy Munitions Board. Training program to increase production level of present skilled labor; defense legislation continues

By ROBERT COLBORN

WASHINGTON—Dress rehearsal for priorities has started. A priorities division has been set up in the Army and Navy Munitions Board, headed by Lieut. Col. A. B. Johnson, which will set up a more or less informal mechanism easily convertible into a definite priority system. Plans made by the division clear through Donald Nelson, defense commission coordinator of procurement. When actual priorities are brought in, Nelson, a former Sears-Roebuck purchasing executive, will be in charge. Press reports that Leon Henderson will have the job are incorrect.

Primary job of the priorities division is to establish the relative urgency of various Army and Navy orders, to keep manufacturing geared to the orderly expansion of the armed forces. It will decide that this order for tank armor comes ahead of that order, with a ship's armor order in between.

Priority of military over commercial orders is intended to be attained simply through the delivery date on the contract. When the supplier takes the contract he obligates himself so to reshuffle his existing orders that he can meet the delivery date. Whether suppliers themselves will demand formal priorities to protect themselves against resentment of commercial customers remains to be seen. In any case little trouble is expected except perhaps in a few items such as armor plate, optical glass, certain aluminum products, rifle boring machinery, and heavy forgings.

Where this system might break down is in the case of sub-contractors and material suppliers. If difficulty develops, the defense commission will be called in. Although admitting that priorities will come sooner or later, the commission wants to stave them off as long as possible. Probable first step will be informal industry-wide agreements such as the one already worked out by machine tool manufacturers.

Groundwork for a similar arrangement in the forging field was apparently laid late last month when representatives of fifteen manufacturers of heavy forgings were called to Washington to meet with Army, Navy, Maritime Commission, and defense commission officials. They were informed that the three agencies will need over the next three years about 360,000 tons of heavy forgings—guns up to 16 in., ship shafting, rudder posts, turbine rotors, etc. No formal action was taken at the meeting beyond this announcement, and no date was set for a later meeting. It is presumed, however, that the manufacturers will discuss the assignment and determine what expansion is feasible and whether allocations of deliveries will have to be made

Legal basis for priority of military over civil orders, whenever the President desires, was established in recent legislation. It is thought likely however that further legislation will be sought soon permitting priorities as between different commercial orders.

Defense Training Speeded

Meanwhile the defense training program is beginning to get away from its first chaotic visions of millions of high school boys learning to be machinists. In an effort to coordinate the half dozen agencies attacking the training program, Sidney Hillman, defense commission labor man, late last month called in a committee of six industrialists (airplanes, steel, ships, electrical goods) and six labor leaders to set up some kind of over-all policy. They agreed that the route to quick results is to step up the level of present skilled labor rather than try to start from scratch—i.e. turn a machinist into a tool and die maker and a machinist's helper into a machinist. The two big reservoirs are the unemployed skilled men and the men now employed at lower-grade skilled jobs. The first group, where the main problem is refurbishing dusty skills, is to be handled through the WPA-Office of Education program, which already has 40,000 men under training and is working towards 150,000. The second group will be a job for industry itself to handle through various forms of in-service training.



Defense Head—*Harold Vance, chairman of Studebaker, has charge of machine tools for the National Defense Advisory Commission under William S. Knudsen*

Meanwhile, the Labor Department announced that the defense program had resulted in a contra-seasonal increase (235,000) in June industrial employment. It estimated that, as of June, more than 300,000 men were employed in defense industries: Shipbuilding, 88,600; aircraft, 70,300; machine tools, 64,800; engines, 50,600; aluminum, 27,000; explosives, 7,500 Percentage increases in these industries over 1937 were 26, 46, 18, 18, 3, and 2 respectively.

Legislation Continues

With Congress likely to stay in session till after election, the mill of defense legislation grinds along. The two-ocean navy bill authorizing a 70 percent expansion of the permitted size of the fleet has been signed and is now law Lots of people still do not understand that there is no money in this bill. It merely authorizes the Navy to go ahead when Congress provides the $4,000,000,000 needed. Only a few hundred million for the necessary shipyards and armor plants will be provided this year Congress has passed a measure appropriating $25,000,000 to start a $65,000,000 defense power project in the Tennessee Valley. Major items still pending are as follows:

The $5,000,000,000 appropriation to provide equipment for a 2,000,000-man army and 19,000 more planes. This bill will pass soon substantially unchanged The rider which raises airplane profits is academic, since the tax bill will substitute a different system.

This bill limits armament profits, establishes amortization procedure for defense plants, and repeals special limits on profits.

Wright Aeronautical Locates $92,000,000 Plant at Cincinnati

WASHINGTON—Decision of Wright Aeronautical to locate its $92,000,000 engine plant at Cincinnati not only doubles Wright's production of military-type radial engines, adding 12,000 a year of capacity, but also marks the first big break in industry's resistance to the administration's desire for decentralization of defense plant.

By the same token it substantially reduces the likelihood of government construction of plant facilities paralleling private industry. Government plants definitely scheduled (the $25,000,000 powder plant near Louisville, Ky., a shell-loading plant soon to be announced, etc.) are for products with no commercial equivalent. Possibility of other types arose through desire to control locations—admittedly not possible as regards private expansions—or through too slow private plant construction. Fruition of the long pending Wright negotiations was a major cause of the War Department's announcement that it contemplated no immediate construction of federal aircraft plants.

The Wright plant is being financed through an RFC defense loan and is the first big one apart from the $165,000,000 loaned to the RFC-created metals and rubber corporations for purchase of strategic materials. Nine smaller loans aggregating $16,000,000 have been made, but RFC has made no statement as to the recipients.

Disinterested Executives Seen Responsible for "Learner" Failures

SILVER BAY, N. Y.—Lack of attention by top executives is largely responsible for failure of "learner" training programs wherever they have proved unsuccessful, stated Warner Seely, secretary Warner & Swasey Co., in a talk July 25 at the annual Silver Bay Industrial Conference. Once launched, these programs sometimes have been allowed to drift along without proper study, supervision and direction.

Mr. Seely pointed out that the most important factors in operating a learner program are a careful selection of trainees, getting foremen training-conscious, and making a frequent and accurate check-up of individual learner's progress. The learner courses are generally considered the most effective single method of attacking the emergency training problem. Classroom work consists of blueprint reading, shop mathematics, use of measuring instruments, elementary applied mechanics, and machine shop practices. It is followed by training in the plant.

U. S. Government Contracts Awarded to Metal-Working Firms

(Other Metal-Working Contracts on Page 590d)

Contractor	Gov't Agency	Commodity	Amount
Babcock Printing Press Corp., New London, Conn	War	Machined shell	$183,131
American Forge Div., American Brake Shoe & Foundry Co., Chicago, Ill	War	Shell forgings	70,235
Lundquist Tool & Mfg. Co., Worcester, Mass	War	Telescope mounts	144,950
Fort Pitt Bedding Co., Pittsburgh, Pa	War	Metallic belt links	419,200
Guide Lamp Div., General Motors Corp., Detroit, Mich	War	Cartridge cases	149,362
Caterpillar Tractor Co., Peoria, Ill	Navy	Tractors	62,640
International Harvester Co., Chicago, Ill	War, procurement	Tractors	88,116
General Motors Corp., (Chevrolet Div.), Detroit, Mich	Agriculture	Trucks	117,116
Fairchild Aircraft Div., Fairchild Engine & Airplane Corp., Hagerstown, Md	CAA	Airplanes	50,050
Thomas B. Martindale, Inc., Philadelphia, Pa	Navy	Station wagons	34,790
Yellow Truck & Coach Mfg. Co., (General Motors Truck & Coach Div.) Pontiac, Mich	War	Trucks	68,380
United Aircraft Corp., East Hartford, Conn.	Navy	Aircraft magnetos	24,725
Weatherhead Co., Cleveland, Ohio	Philadelphia	Couplings and fittings	42,697
Grumman Aircraft Engineering Corp., Bethpage, N. Y.	Navy	Parts for airplanes	32,895
Marmon-Herrington Co., Indianapolis, Ind	War	Trucks	99,778
Pullman-Standard Car Mfg. Co., Pittsburgh, Pa	War	Shells	253,987
Lake Washington Shipyards, Houghton, Wash	Navy	Tank hauks	394,250
Doehler Die Casting Co., Pottstown, Pa	War	Die castings	50,087
Struthers Wells-Titusville Corp., Titusville, Pa	War	Breech rings	23,156
Edwards Mfg. Co., Cincinnati, Ohio	Navy	Practice bombs	53,100
Merit Supply Co., New York, N. Y.	Air Corps	Chock assemblies	31,248
General Bronze Corp., Long Island City, N. Y.	Air Corps	Cradle assemblies	29,014
Farrel-Birmingham Co., Ansonia, Conn	United States	Rolling mill unit	23,396
Kay Products Co., Detroit, Mich	War	Engine hoists	31,800
Yale & Towne Mfg. Co., Stamford, Conn	War	Fuel servicing pumps	122,629
Corbitt Co., Henderson, N. C.	War	Trailers	30,455
Largo Motor Corp., Detroit, Mich	War	Trucks	929,265
Pump Engineering Service Corp., Cleveland, Ohio	War	Pump assemblies	36,066
Medi Blumberg Corp., New Holstein, Wis	Navy	Trailers	25,264
Stewart Motor Co., Washington, D. C.	Procurement	Automobiles	26,201
Link Aviation Devices, Inc., Binghamton, N. Y.	War	Trainer assemblies	509,182
Mack International Motor Truck Corp., Washington, D. C.	War	Transportation auxiliaries	82,860
Hart Mfg. Co., Louisville, Ky.	War	Army ranges	59,578
Wm. R. Bootz, Evansville, Ind	War	Fire units for field range	50,724
Remington Rand, Inc., Buffalo, N. Y.	War	Cabinets for field range	98,839
American Safety Razor Corp., Brooklyn, N. Y.	War	Safety razors	29,064
Eclipse Aviation Div., Bendix Aviation Corp., Bendix, N. J.	War	On-carriage parts	267,191
Peco Mfg. Corp., Philadelphia, Pa.	War	Eyebolt lifting plugs	106,947
North & Judd Mfg. Co., New Britain, Conn.	War	Tips, clamps and slides	35,431
Hunter Steel Co., Pittsburgh, Pa.	TVA	Radial gates	202,000
Marshall Stove Co., Lewisburg, Tenn.	War	Stoves	25,002
St. Louis Furnace Mfg. Co., St. Louis, Mo.	War	Room heaters	27,982
Phillips & Buttorff Mfg. Co., Nashville, Tenn.	War	Heating stoves	22,210
Aluminum Cooking Utensil Co., New Kensington, Pa.	War	Range equipment	67,719
General Fireproofing Co., Washington, D. C.	Navy	Aluminum chairs	83,093
General Bronze Corp., Long Island City, N. Y.	War	Dolly assemblies	54,652
Scovill Mfg. Co., Waterbury, Conn.	War	Primer bodies	276,000
Electric Boat Co., Groton, Conn., Maxim Silencer Co., Hartford, Conn.		Mufflers, evaporators, distillers	64,260
York Ice Machinery Corp., Philadelphia, Pa.	Navy	Refrigerating equipment	126,641
General Electric Co., Schenectady, N. Y.	Aeronautics, War	Electrical equipment, Propeller-drive unit	75,622
Stinson Aircraft Div., Aviation Mfg. Corp., Nashville, Tenn.	CAA	Airplane	24,070
Engineering & Research Corp., Riverdale, Md.	Navy	Blades	81,100
American Car & Foundry Co., New York, N. Y.	War	Tank cars	216,054
Late-Root-Heath Co., Plymouth, Ohio	War	Locomotives	33,912
Stearman Aircraft Div., Boeing Airplane Co., Wichita, Kansas	Navy	Airplanes	3,779,628
Ranger Aircraft Engines Div., Fairchild Eng. & Airplane Corp., Farmingdale, N. Y.	Navy	Airplanes engines	5,480,308
Bath Iron Works Corp., Bath, Maine	Navy	Destroyers	9,796,000
Federal Shipbuilding & Dry Dock Co., Kearny, N. J.	Navy	Destroyers	10,554,000
Bendix Aviation Corp., Marine Div., Brooklyn, N. Y.	War	Range correction boards	76,573
Eastman Kodak Co., Rochester, N. Y.	War	Telescopes	39,922
Bausch & Lomb Optical Co., Rochester, N. Y.	War, Navy	Telescopes, trainers	281,218
Sperry Gyroscope Co., Brooklyn, N. Y.	War	Searchlights	803,400
Bendix Aviation Corp., Pioneer Instrument Div., Bendix, N. J.	War	Indicators and transmitters	31,920

NAMES in the NEWS

Frank H. Gordon, vice-president in charge of sales at Lukens Steel Co., Coatesville, Pa., recently celebrated his 45th anniversary as an associate of the company. After having held various clerical positions in the organization, Mr. Gordon was named assistant general sales agent in 1903. He has been vice-president since 1928.

R. A. Hill, formerly mid-continent manager for the Regan Forge & Engineering Co., has been appointed manager of a new branch office and warehouse in Houston, Texas., to be opened by John A. Roebling's Sons Co., Trenton, N. J. Mr. Hill will have charge of sales and the local stock of Roebling's complete line.

Howard R. Salisbury has been appointed manager of the Air Reduction Sales Co. at Philadelphia, Pa. He has been connected with Airco for fifteen years.

J. Eugene Jackson has been appointed metallurgical engineer of the Copper Iron & Steel Development Association, Cleveland, Ohio. He will act as technical service representative of the association of copper producers.

Clinton E. Stryker has been appointed vice-president and assistant to the president of the Nordberg Mfg. Co., Milwaukee, Wis.

C. O. Bartlett has been appointed district manager in the Detroit territory for the C. O. Bartlett & Snow Co., Cleveland, Ohio. Mr. Bartlett is the son of the founder and organizer of the company.

James H. Jewell has been named manager of agency sales by Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

John A. Brown has retired from Heppenstall Co., Pittsburgh, Pa., after having served for 40 years. Harry E. Reith, formerly with Brooks Oil Co., has been appointed special service representative, the position formerly held by Mr. Brown.

George I. Allen, office manager of Heppenstall Co., Cleveland, Ohio, has also retired. He is being succeeded by his son, Jack R. Allen.

G. V. Patrick has been appointed director of sales for the Cleveland Automatic Machine Co., Cleveland, Ohio. H. A. Gray, formerly connected with the U. S. Army Ordnance Department, succeeds Mr. Patrick, as eastern sales manager. F. C. Reese, formerly sales engineer with the Cincinnati Milling Machine Co., has been appointed district sales manager with offices at 314 American Building, Cincinnati, Ohio.

Celebrates Anniversary



FRANK H. GORDON

District Manager



C. O. BARTLETT

New Appointee



J. EUGENE JACKSON

Charles F. Woodward was named manager of Western Steel Products Corp., Ltd., company's office and factory at Calgary, Alberta, Canada.

Lawrence Rigdon, Carl Coler and William O'Connell have been appointed to the posts of manager of manufacturing, manager of industrial relations, and auditor respectively, of the Emergency Products Div., Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa. This division, which has been organized just recently, will produce defense equipment under the government's preparedness program.

J. Russell Penman has been appointed production manager in Copperweld Steel Company's new alloy steel plant in Warren, Ohio. Mr. Penman was previously connected with Central Steel Co., Republic Steel Corp., and United States Steel Corp.

Claire C. Balke has rejoined the Research Staff of Fansteel Metallurgical Corp., North Chicago, Ill.

Frank W. Ladky, Wisconsin representative for the Corey Steel Co., Cicero, Ill., for the past twenty years, has been elected a director of the company.

John P. Moran, vice-president in charge of production of the Gemmer Mfg. Co., Detroit, Mich., has been elected president to succeed the late Edward P. Hammond. Mr. Moran has been a member of the company since 1910.

Aircraft engineer, Carleton E. Stryker, has been added to the headquarters staff of the Society of Automotive Engineers to take charge of the society's national defense responsibilities pertaining to aircraft and aircraft-engine parts and materials.

Alexander Sellers, president of William Sellers & Co., Philadelphia, Pa., has been elected chairman of the board. He is succeeded as president by George H. Benzon, Jr., who has held the post of vice-president.

PLANT EXPANSION

Cowles Detergent Co., Cleveland, Ohio, has moved to larger offices at 7016 Euclid Ave.

Falk Corp., Milwaukee, Wis., is scheduled to erect a $50,000 addition to its existing plant.

Union Carbide & Carbon Corp., New York, N. Y., is expanding its plant in Kokomo, Ind., by the addition of a new one-story factory building. The new structure will house machinery to be used in the manufacture of Haynes Stellite alloy products.

Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., will construct a new $560,000 warehouse which will provide an additional 126,000 sq.ft. of space. A new metal stamping building which will cost approximately $500,000, and an additional construction of two stories on one of the main buildings of the plant are added features of the organization's expansion program.

Marmon-Herrington Co., Indianapolis, Ind., is scheduled to double the size of its factory in conjunction with its active participation in the new national defense program.

Worthington Pump & Machinery Corp. will construct a new $75,000 addition to its Buffalo plant. The new unit, 145x114 ft., will be used to expand the assembly and testing de-

partment of the larger gas and diesel engines.

Curtiss-Wright Corp. has filed a petition with the Tonawanda Town Board to erect a new $100,000 office building at Tonawanda, N. Y.

An addition to the aircraft factory building of North American Aviation, Inc., is being erected at 5701 Imperial Highway, Los Angeles, Calif. The expansion will cover an area of 25 x 420 ft. at a cost of $24,000.

Menasco Mfg. Co., Los Angeles, Calif., will erect a new aircraft engine factory at Burbank, Calif. The new building will have an area of 50,000 sq. ft. of floor space and is scheduled to be completed in 90 days.

Curtis Lighting, Inc., manufacturers of lighting equipment, is expected to erect a $175,000 general office and factory building at Paducah, Ky. The company, now located at 1123 W. Jackson Blvd., Chicago, will be moved as soon as it secures a title for a plant site and $35,000 to be raised by public subscription.

Work has begun on a new $2,000,000 headquarters for the General Electric Co., at 840 So. Canal St., Chicago, Ill. The building, which is scheduled to be completed in September will occupy one square block, have seven stories, and house nine General Electric divisions.

Ericcson Screw & Machine Co., Brooklyn, N. Y., will construct a $75,000 factory unit on the Boston Post Road at Norwalk, Conn.

United Aircraft Corp., East Hartford, Conn., has leased the entire first floor of the three-story plant of Cheney Bros. at Manchester, Conn. The Aircraft Co. now has 19,000 sq. ft. of floor space which will be used for storage purposes.

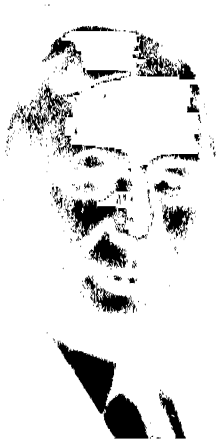
OBITUARIES

Paul S. Moyer, chairman of the board, Aridor Co., Chicago, Ill., died recently, at the age of 49.

Fred Beswick, 45, former superintendent of the foundry at Caledonia Bean Harvester Co., died at his home in LeRoy, N. Y., following an illness of several months. Ill health had caused Mr. Beswick's retirement.

William Henry Harrington, 48, Eastern sales manager of New Departure Div. of General Motors Corp. at Bristol, Conn., died recently following an operation. Mr. Harrington had been associated with New Departure since 1917.

Dies



CHARLES H. HELLER

Charles H. Heller, chairman of the board, Bower Roller Bearing Co., died suddenly July 26 With R. F. Bower and others, Mr. Heller organized the Bower Co. at Dayton, Ohio, in 1907.

Charles A. Goodspeed, who was connected with Henry Prentiss & Co for 40 years previous to his retirement in 1928, died recently.

Fred C. Reis, secretary for many years of the Boye & Emmes Machine Tool Co., Cincinnati, Ohio, died July 23.

BUSINESS ITEMS

Sheller Mfg. Corp, Portland, Ind., manufacturers of steering wheels, has purchased the radiator shutter business of Pines Winterfront Co., Chicago, Ill.

Cummins Diesel Sales of British Columbia, Ltd., machinery dealer, has been incorporated with an authorized capitalization of $10,000. The new firm is located at 703 Rogers Bldg, 470 Granville St., Vancouver, B. C.

Reliance Machine & Tool Co., Ltd., has changed the name of the firm to Reliance Aircraft & Tool Co., Ltd., with offices in Belleville, Ontario, Canada.

John W. Dobson has been appointed an Eastern sales representative of the Cowles Detergent Co., Cleveland, Ohio.

Callite Tungsten Corp., Union City, N. J., has taken over Harris Alloys, Inc.

Ransome Concrete Machinery Co., Dunellen, N. J., has appointed the following sales representatives: Wessendorff, Nelms & Co., 320 Franklin Ave., Houston, Texas; Welding Sales & Engineering Co., 1628 W. Fort St., Detroit, Mich.; Jones-Sylar Supply Co., 1800 Central Ave., Chattanooga, Tenn.; Arcway Equipment Co., 3717 Filbert St., Philadelphia, Pa.; and Hobart Welder Sales & Service, 6715 Carnegie Ave., Cleveland, Ohio.

Fuji Trading Co., Osaka, Japan, has been newly incorporated to take over the entire overseas business formerly handled by the export department of Y. Kodama Shoten.

Walter C. Davis will represent American Machine & Metals, Inc., of East Moline, Ill., in Maryland, Virginia and the District of Columbia.

Republic Machinery Corp., Toledo, Ohio, has been formed to take over the Machine Tool Div., of the National Supply Co. H. E. Oatis, who has been branch manager of the Toledo Store of the National Supply Co., will head the new organization as president and treasurer. Offices are at 416 Richardson Bldg.

Huie Simmer Co., 103 Thomas Bldg., Dallas, Texas, has been appointed district sales representative in the state of Oklahoma for the complete line of Trico Fuse Mfg. Co., Milwaukee, Wis.

Medart Co., St Louis, Mo., has purchased the entire wood pulley stock of the Reeves Pulley Co., Columbus, Ohio, and will continue to serve all of the wood pulley dealers and customers of the latter organization

A new company, the U. S. Electric Welder Corp., 1224 W. Bancroft St., Toledo, Ohio, has been incorporated by J. L. Fosnight, who will act as president and general manager.

The Stumpfl Co., Emporium, Pa., manufacturer of cutting tools, is being reorganized into a new firm to be known as the Cameron Mfg. Corp.

MEETINGS

Porcelain Enamel Institute. Fifth annual forum, University of Illinois, Urbana, Ill. Oct. 16–18.

Society of Automotive Engineers. National tractor meeting, Schroeder Hotel, Milwaukee, Wis., Sept. 24–25. Annual dinner, Hotel Commodore, New York, N. Y., Oct. 14.

American Institute of Electrical Engineers. Pacific Coast convention, Los Angeles, Calif., Aug. 26–30.

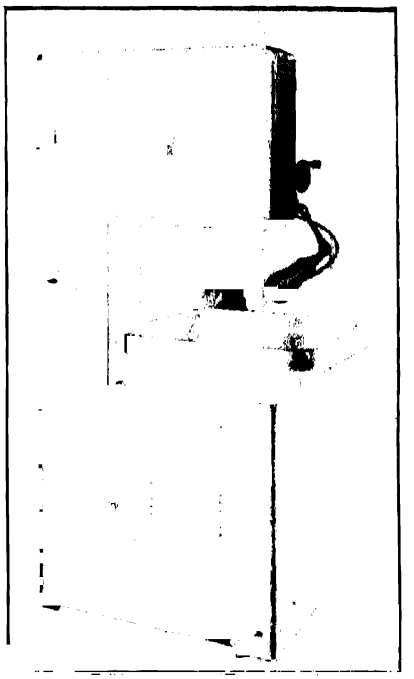
American Society of Mechanical Engineers. Fall meeting, Spokane, Wash., Sept. 3–6.

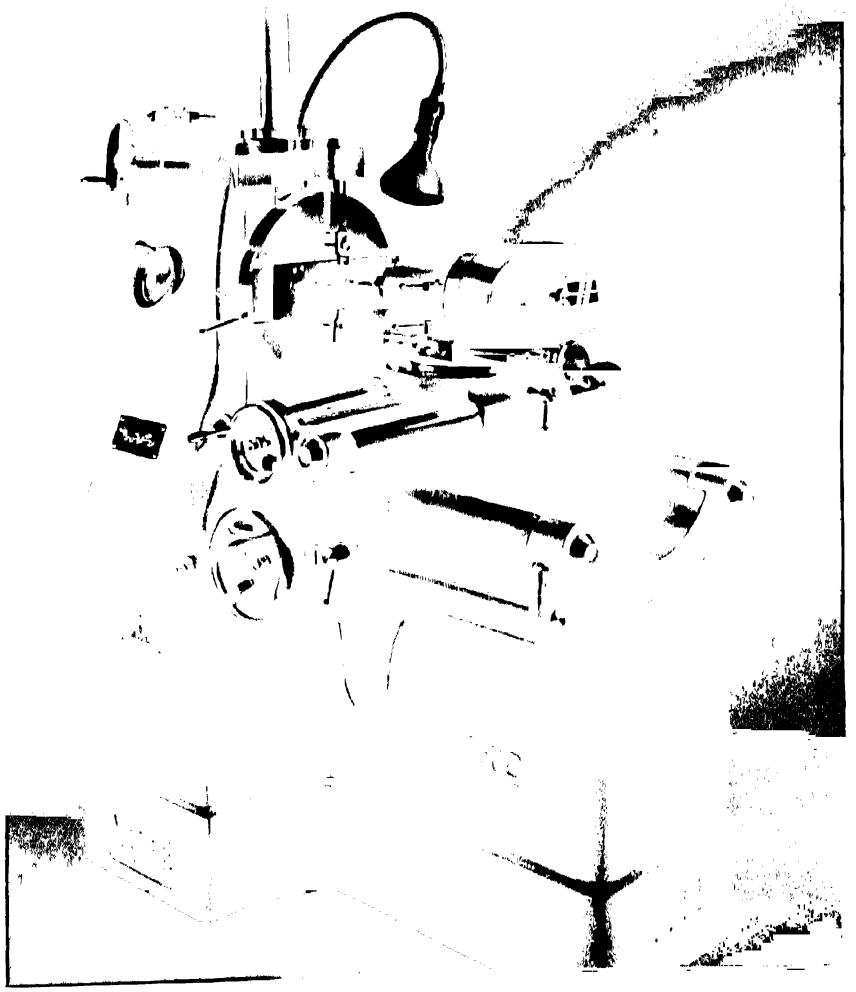
SHOP EQUIPMENT NEWS

"Autometric" Jig Borer Serves Also As Precision Layout and Inspection Machine

Offered by Meyer Mechanical Laboratory, 1849 Sacramento St, San Francisco, Calif., the "Autometric" jig borer has been designed from the ground up to offer greater accuracy, greater versatility and greater speed of operation in jig boring In addition to functioning as a jig borer, this unit also serves as a universal layout and inspection machine

For small-lot production work the versatility and speed of this machine make possible a wide variety of production boring without expensive attachments or accessories Operations possible on the machine include: locating, boring, inspecting and layout in one set-up; angular boring of holes at any angle; taper boring at any angle, and rapid measuring by built-in mechanical counters Features include steel ways hardened, ground and lapped, automatically oiled, independent speeds and feeds; infinite number of feeds from zero to 3½ in per min, fourteen feeds from 30 to 2,350 r p m, V-belt driven spindle; and super-precision roller bearings in spindle and rotary table.





Grob Metal Bandsaw Built for Toolroom

To fill the increasing demand for an all-round metal bandsaw, Grob Bros, Grafton, Wis, have developed the Model No. NS-18 bandsaw. This machine is built for the toolroom as well as for the general machine shop

The machine consists of a one-piece welded steel frame, reinforced for rigidity A cast iron table, 24x24 in, is tiltable four ways A butt welder with built-in tool grinder is mounted in the frame Both upper and lower saw guides are adjustable Lower guide can be brought above the table surface for special jobs

A 1-hp motor drives the machine through V-belts. All pulleys are mounted on ball bearings Speeds range from 50 to over 2,000 ft per min Throat is 18 in deep and distance from table to upper column is 12 in Machine will cut extra-heavy jobs with ease, using saw blades up to 1 in wide A chart for the proper selection of saw blades is mounted on the machine Net weight is 1,000 lb.

Rome Polishing Lathe Finishes at Slow Speed

Especially well adapted to the requirements of the slow-speed loose-abrasive method of finishing, the Rome Model THMO heavy-duty two-motor double-spindle polishing and buffing lathe can be arranged for heavy-duty automobile bumper rail polishing and buffing, and can also be equipped with long overhanging wheel spindle housings for agricultural implement finishing.

Machine illustrated is equipped with two 10-hp totally inclosed fan cooled ball bearing motors and pushbutton operated magnetic starting switches Motors up to 25 hp can be accommo-



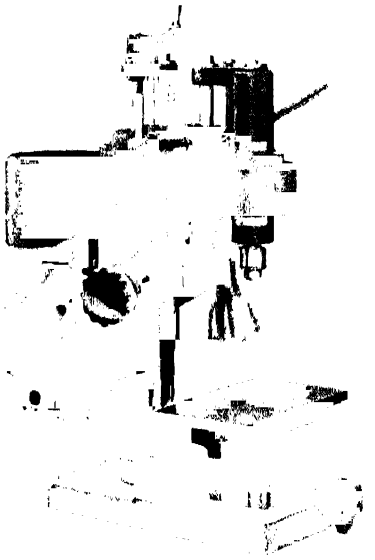
dated in the machine. Spindles will carry 18 to 36 in. diameter, 8-in. face wheels with 2-in arbor holes. Wheel dust hoods of any design can be furnished to specification, complete with mounting brackets.

Chrome-manganese alloy steel wheel spindles, ground and balanced, are mounted on multi-sealed ball bearings having exceptionally high load capacity. Net weight, complete with two 10-hp. motors, is 3,100 lb.

Super Sensitive Drill Has Wide Speed Range

The "Maxi-Varimatic" super sensitive drilling machine offered by Hamilton Tool Co, Hamilton, Ohio, has been designed to afford greater flexibility of operation and higher performance through the use of an exceptionally wide range of speeds. Complete speed range of the machine is from 840 r.p.m. to 9,300 r.p.m., with a 1,725 r.p.m motor. Speed adjustment is infinitely variable in two ranges.

This machine is claimed to be built with instrument precision, and to be suitable for use on the finest work in toolrooms, or in instrument, diesel, electrical, aircraft and other precision manufacturing. Exceptional convenience of operation enhances its usefulness. Drilling unit is self-contained, and swings radially on the column and locks to any position. The 6½-in. vertical adjustment is accomplished by means of an elevating screw.



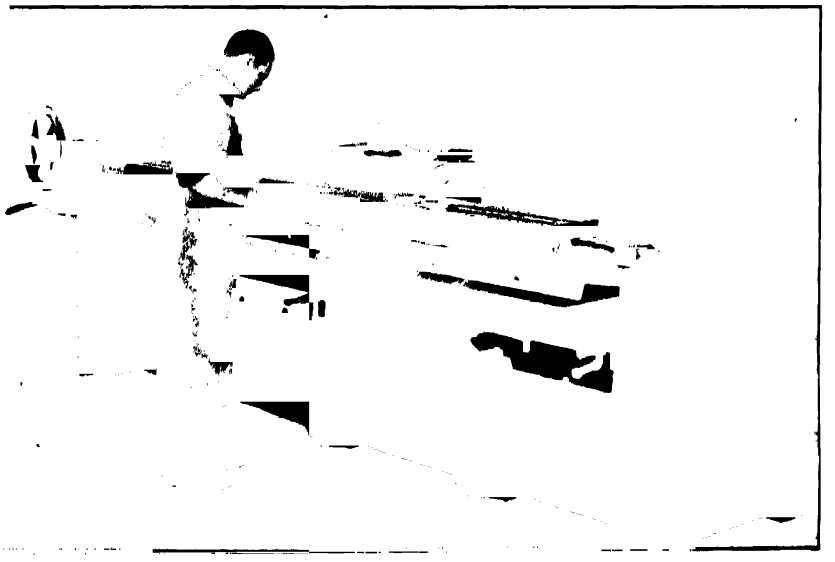
Seybold Precision Shear Knife Grinder Sharpens Most Kinds of Straight Knives

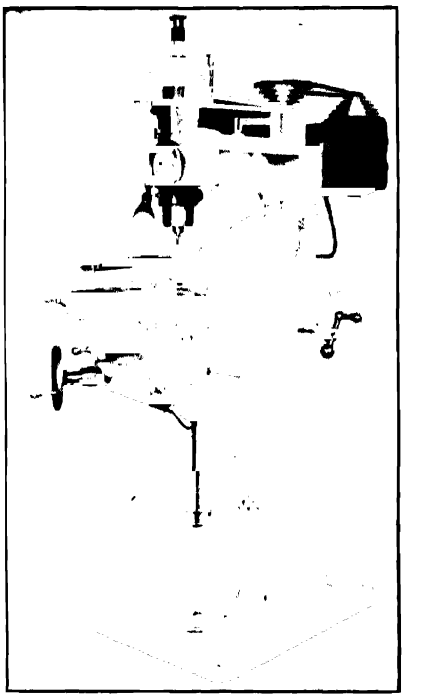
Developed by the Seybold Div. of Harris-Seybold-Potter Co., Dayton, Ohio, a high-speed precision knife grinder is capable of sharpening almost all straight knives in general use. Having an automatic grinding wheel feed and centrifugal pump cooling system, it removes an absolute minimum of metal, quickly producing a keen cutting edge which requires little honing.

Machine does not require an experienced operator, and grinds equally well shear blades or beveled knives such as planer, chipper, hog, barker, veneer, paper, rag, granulating, tobacco, scraper and doctor blades. A unique feature is a hollow three-sided knife bar, each surface of which presents a different series of angles to the action of the traveling grinding wheel. A fourth open side makes it easy to bolt or clamp the various types of blades to the bar.

In designing the machine, special consideration has been given to shear blade grinding. A variety of sizes can be accommodated, and widths up to 6 in. can be ground satisfactorily. Adjacent surfaces of the knife bar are made to accommodate almost all straight edge knives in general use.

Simplicity has been attained without eliminating any of the desirable features of the company's older precision knife grinder, it is claimed. All gears and clutch operate in an oil bath to insure quiet, trouble-free service. Only the floor space occupied by the base is required for operating the grinder. It is made in three sizes, 70-in., 100-in. and 128-in. lengths.





"Millmaster" Vertical Miller Designed for Wide Range

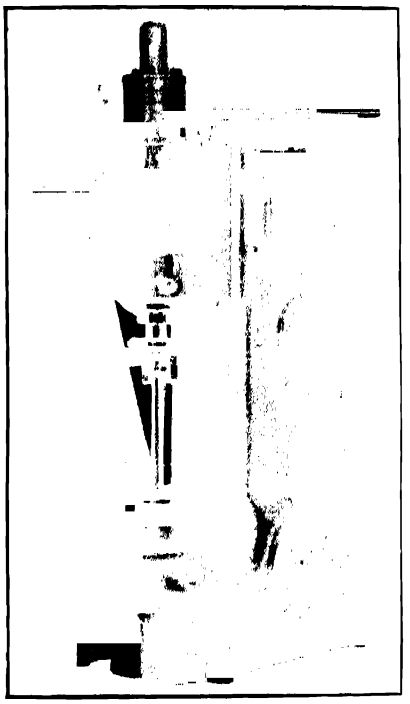
Designed for a wide range of work with high speed and high precision, the No. 2½ "Millmaster" vertical milling machine is offered by Midway Machine Co., 2324 University Ave, St. Paul, Minn. The standard two-pulley model provides spindle speeds of 275 to 4,300 r.p.m., while the three-pulley model has speeds ranging from 70 to 10,000 r.p.m. This wide range of speeds makes the machine extremely versatile, as the same machine may be used for work in metal, wood and plastics without change.

Features include: 1-hp. ball-bearing

motor and reverse controller; preloaded duplex oversize ball bearings on spindle; all flat and V bearing surfaces scraped in against master plate. Over-all height of stationary-quill model is 72 in.; that of movable-quill model is 80 in. Net weight is 1,600 lb.

"Incolap" Gear Finisher Built for Small Gears

Standing only 32 in. high, the bench model "Incolap" gear finishing and correcting machine is offered by Gear Processing, Inc., 6700 Grant Ave., Cleveland, Ohio. With this unit gears may be rough and finish hobbed,



shaped, or rough cut and shaved. Then after hardening, they go through the laps to remove errors in both cutting and hardening operations. The "Incolap" process is not designed to remove large amounts of stock, but rather to correct gears properly cut with a normal amount of production error.

Primary function of the machine is to reciprocate the gear and surrounding lap in relation to each other. For large production where many gears of the same kind are to be corrected, laps are broached from electric furnace iron and later hardened. For transmission gears, laps are usually from 3/16 in. to 1½ in. thick. For larger gears, and for worms or splines, the laps may be as long as 4 in. By use of thin laps, close clearance gears can be finished, provided there is ⅛ in. between gear being lapped and the adjacent gear or shoulder.

Bench model illustrated will take gears from ¼ to 2 in. in diameter. Weighing less than 200 lb., it has manual control for stopping and starting, for lifting gear for indexing or at the finish of the cycle and for controlling pressure between gear and lap. Provision is made for automatic control of these motions, using a time clock mechanism and actuating air cylinders.



Automatic Cross Feed Available for B&S Grinders

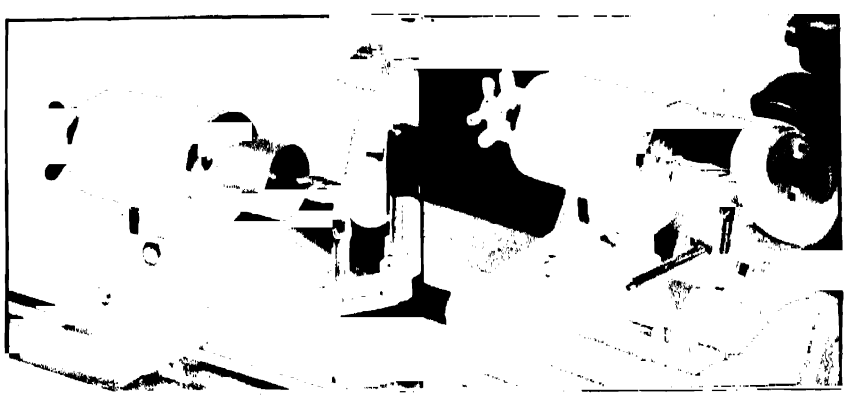
Brown & Sharpe Mfg. Co., Providence, R. I., has developed an independent automatic cross feed arrangement for its No. 5 plain grinding machines. Automatic straight-in-feed grinding, with the machine table stationary, may be performed with this attachment, which gives the machine all the advantages of power plunge-cutting with no change in its regular capacities or operating convenience. The arrangement furnishes 172 plunge-cut feeds or picks per minute, with the amount of feed adjustable by quarter-thousandths from 0.00025 in. to 0.0045 in. per pick. As with the regular cross feed, the stopping point can be set by increments of 0.0001 in.

A separately controlled 1.20-hp. gearhead motor mounted at the right front of the machine drives continuously a variable-radius crank mechanism which is mounted below the similar unit regularly a part of the machine. Arrangement includes a vertical link which transmits motion to the cross-feed pawl from either of two crank mechanisms. Selections of feed for traversing or straight-in-feed grinding is made simply by connecting the link to the proper crank mechanism by a machine screw and hardened bushing fitting either of two holes in the link. Amount of feed per pick is selected simultaneously by a pointer and scale on the rotating members before the screw is tightened. Entire arrangement is simple and compact, and is effectively guarded for safety. It is applied to the machine before shipment from the factory, and increases the weight by approximately 15 lb.

Brown & Sharpe Tool Grinding Attachments Aid in Sharpening Steep Spiral End Mills

Nos. 10 and 13 end mill grinding attachments for B&S No. 10 cutter and tool grinding machine and No. 13 universal end tool grinding machine respectively have been developed by Brown & Sharpe Mfg. Co., Providence, R. I., especially for sharpening the peripheral teeth of steep spiral end mills having straight or taper shanks.

A knob at the rear end of the attachment spindle makes it easy to hold the tooth being ground in contact with the tooth rest, while feeding the cutter across the wheel by a longitudinal table movement. Mounting of the spindle on anti-friction bearings provides a sensitive, free-turning unit, of special advantage when sharpening



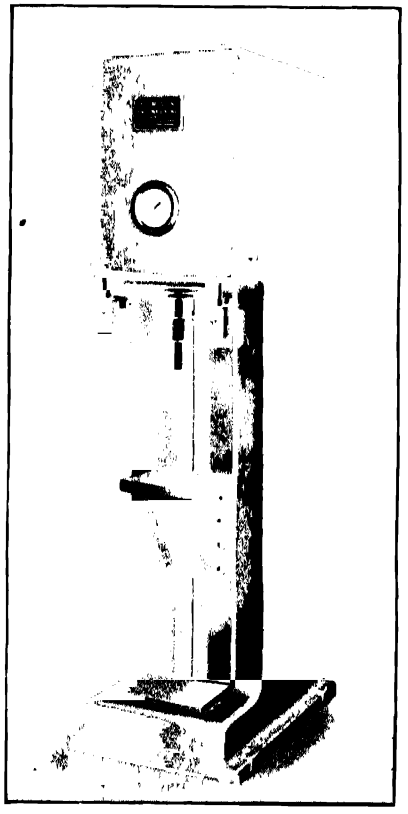
Sharpening the peripheral teeth of steep spiral end mills is made easy with the No. 10 attachment, left, and the No. 13 attachment, right, for the Brown & Sharpe No. 10 cutter and tool grinding machine and the No. 13 universal and tool grinding machine, respectively

very small end mills having a steep spiral.

Attachment spindle is carried in a body supported by and turning horizontally on a base casting. Two zero lines 180 deg. apart assure proper alignment of spindle with machine table when sharpening either right-hand or left-hand cutters. Base is aligned by keys which fit the table T-slot. End mills having a No. 9 B&S taper shank will fit directly into the attachment spindle; while cutters having shanks of other B&S tapers, as well as cutters with milling machine standard taper shanks and straight shanks, are accommodated by stock collets and adapters regularly available. A built-in bolt can be furnished at extra cost for use with spring collets in order to hold straight-shank end mills.

Knee Type Hydraulic Press Permits Rapid Tool Changes

The Type DLKC2 hydraulic press offered by Denison Engineering Co., 236 N. Water Street, Columbus, Ohio, has been arranged especially to facilitate rapid change of tools and fixtures. Suitable for general production press-

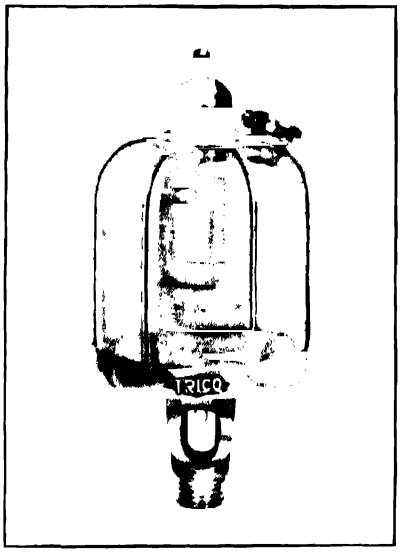


ing operations, it can be quickly retooled with a variety of bolsters, supports or special tools and fixtures. Convenient location of controls, rounded corners and freedom from projections, promote safety and convenience in operation.

Furnished in both 5- and 15-ton capacities, this press is available with either manual or electric control. With electric control, two pushbuttons are arranged so that both must be operated simultaneously. The manually controlled press is furnished with a hand lever or with a foot pedal.

Unbreakable Wick Feed Oiler Aids Intermittent Operation

A visible unbreakable wick-feed oiler offered by Trico Fuse Mfg. Co., 2948 N. 5th St., Milwaukee, Wis., has been developed especially for use on machinery which operates intermittently



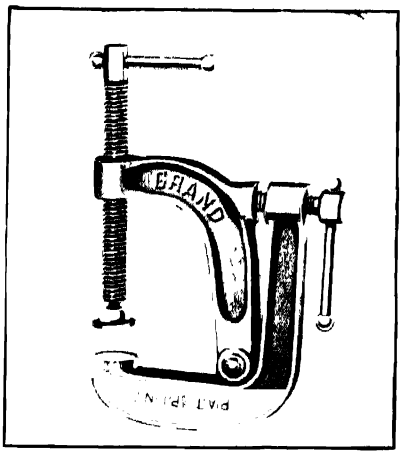
Lever at the top, when in a vertical position, starts the feed, and when flipped to the side, shuts off the feed, preventing flooding and waste of oil when the machine is idle. Oil supply is always visible, and the clear unbreakable reservoir tells at a glance when refilling is necessary.

When oiler is filled above the point where the wick enters the center tube, surplus oil drains into the bearing, thus flushing it thoroughly. When the oil recedes below the opening in the tube, the wick automatically feeds the oil by capillary action. Dirt or sediment cannot enter the bearing. There are no gaskets to leak, as the bottle is cemented and roll-clinched to the heavy brass base. Oilers are available in one, two and four ounce capacities.

Pivoted Clamp Designed To Eliminate Creeping

A clamp offering a solution to the old problem of creeping and shifting of clamps is offered by Grand Specialties Co., 3103 W. Grand Ave., Chicago, Ill. This clamp incorporates the standard clamp principle with an additional vise feature which is said to provide positive grip which eliminates all surface movement of the clamp or material under pressure.

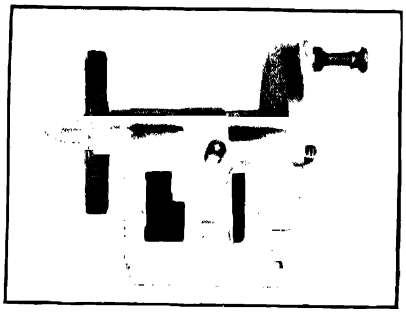
Clamp screw turns in a hinged bracket, the hinge acting as a fulcrum with the base of the clamp



which has a vise screw working against it. It is claimed that this clamp can be used in inconvenient places not accessible to ordinary clamps, and that it develops a holding power that prevents creeping or shifting even on tapered work. It has extra slip-on jaws for clamping pipes, rods and tubing. It is made in two sizes with openings of 3, 4 and 6 in.

Hart Dividing Heads Provide Up To 32 Divisions

Dividing heads of simple construction have been made available by Hart Machine Co., 26 Mather St., Dorchester, Boston, Mass., for a wide variety of work on drill presses, milling machines, shapers and surface grinders. The plain dividing head is mounted on 2½ in. standard milling fixtures



previously described. These heads are available with or without a tailstock assembly. The dividing head can be equipped with a standard driving faceplate as shown, or with a 4 in. Whiton chuck. When arranged with a chuck a hollow spindle which will take up to 9/16 in. round stock is furnished. The index plate is drilled on one side with 18, 20, 22 and 24 holes, and on the other side with 26, 28, 30 and 32 holes. All numbers up to 16 and even numbers up to 32 can be divided.

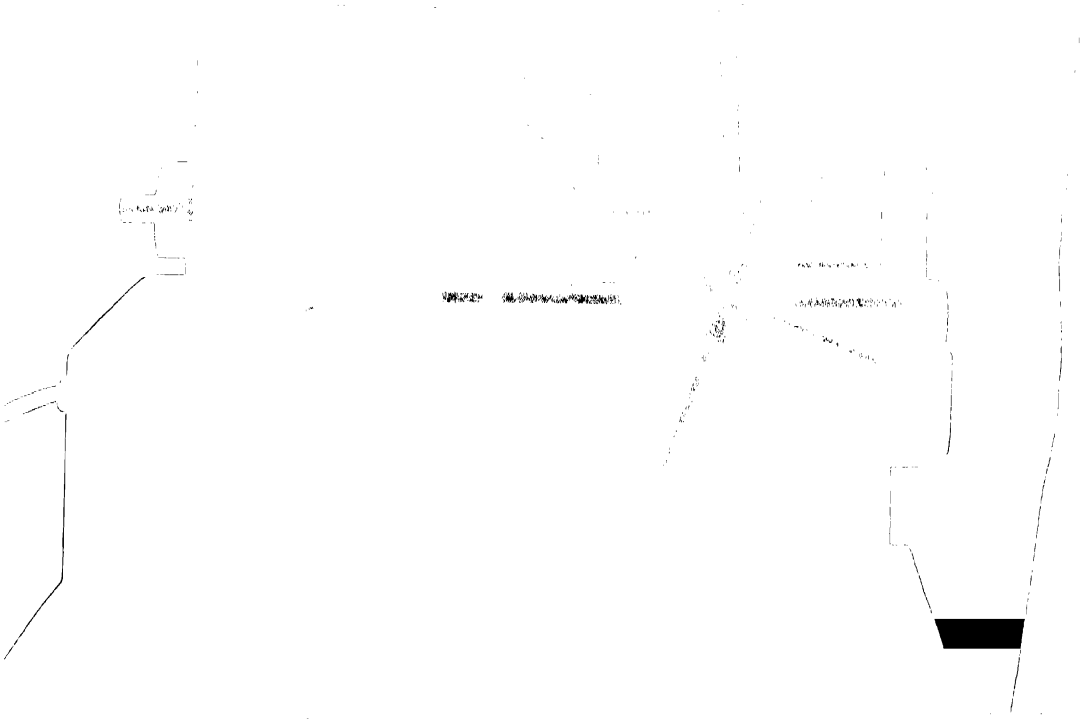
Heavy Duty Tool Set Built for Maintenance

A complete set of pulling tools designed and built especially for industrial maintenance work is offered by

FULL TIME or PART TIM

. . . . It Pays its Way

"Tom Thumb" Threading Machine



Many an OSTER "TOM THUMB" No. 531 works alongside a big bolt machine, filling in when the big fellow is "tied up" on long runs– getting the short runs which it completes before the big one can be set up.

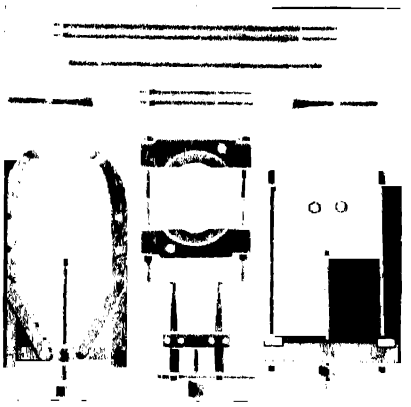
Also a wise choice for the shop which can't keep a big machine profitably busy, the "TOM THUMB" gives surprisingly high and accurate production. Powered by a universal, reversible, variable speed motor, it is simple and economical to operate, and its all BALL BEARING construction insures years of hard service.

Write for the unusually low price and complete description of the "TOM THUMB."

Sales Office: 2049 East 61st Street, Cleveland, Ohio.
Factories: Erie, Penna., and Cleveland, Ohio.
New York City Office: 30 Church St.
Philadelphia Office: 111 No. 3rd St.

OSTER THREADING EQUIPMENT WILLIAMS

THE OSTER MANUFACTURING COMPANY

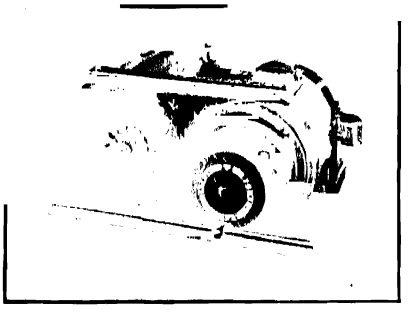


Owatonna Tool Co., 353 Cedar St., Owatonna, Minn. All tools are universal in scope, making it an easy job to remove and replace gears, bearings, wheels, pulleys and other close-fitting parts.

A wide range of adjustments permits these tools to handle the majority of maintenance jobs in any plant. Positive gripping, non-slipping features promote safety. Bearings and other parts which formerly had to be removed and replaced by the "punch and chisel" method, can now be removed and replaced without damage. Set illustrated can be purchased as shown or in individual parts. It weighs 236 lb. complete, mounted on a 4x4-ft. board.

Improved Reeves "Speedial" Combines Indicator and Control

Reeves Pulley Co., Columbus, Ind., has developed an improved type of combination handwheel and speed indicator for use with its variable-speed transmission, "Vari-speed" motor pulley and "Motodrive." Known as the "Speedial," this device accurately indicates speed settings of the various units. Actual indication is a definite number of turns of the speed shifting screw. For each full turn of the shifting screw, the indicator pointer regis-

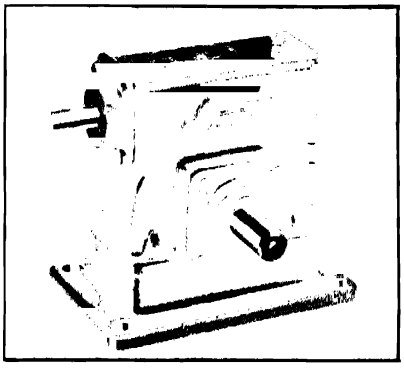


ters one point or degree on the circular scale

It is offered as optional equipment in place of the standard speed control handwheel and indicator on the various Reeves drives It is available for use both on new units and on units already in service While the standard unit is calibrated in turns of the shifting screw, space is available for the user to write his own calibrations in whatever corresponding units he prefers. Depending upon the speed ratio of the unit with which the device is to be used, gear ratios of 20:1, 30:1 and 60:1 are available. Dial is calibrated in accordance with these ratios in from 0 to 20, 0 to 30 and 0 to 60 turns of the shifting screw.

Worm Speed Reducer Handles Small Loads

To supplement its line of speed reducers, Abart Gear & Machine Co., 4832 W. 16th St., Chicago, Ill., has developed an intermediate line of



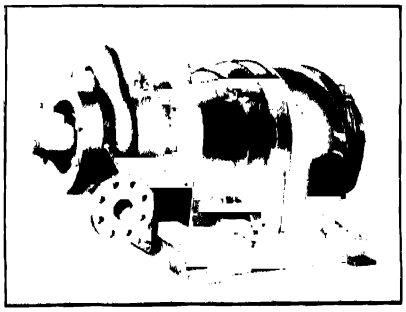
worm reduction units capable of handling power inputs up to 2 hp. Designated as Type 2⅞ A, these new units weigh 22 lb., with ratios ranging from 4 5/6:1 to 100:1.

Worms are made of alloy steel, with hardened and ground threads. Nickel bronze is used for the worm wheel. Shaft mountings are on full ball bearings Gears, wheel and worm are assembled in an oil-tight semi-steel housing with bearing supports for both worm and wheel machined in one casting.

Allis-Chalmers Extends Multi-Stage Pump Line

Allis-Chalmers Mfg. Co., Milwaukee, Wis., has extended its line of multi-stage "SSUnit" pumps to include a two-stage pump with 4-in. suction and 2-in. discharge, which can be rated up to 275 gal per min. against heads up to 50 ft. at a speed of 3,550 r.p.m.

This pump, in which the motor and

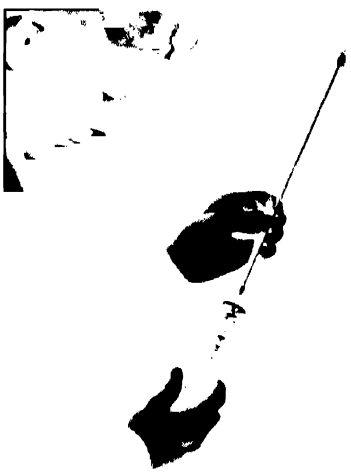


pump housings are bolted together for compactness, has a cast iron casing and cover and is bronze fitted throughout. Cover can readily be removed, permitting inside parts to be replaced without disconnecting suction and discharge piping. Stuffing box is subjected to suction pressure only. This unit can be furnished with either an open, splash-proof, totally inclosed or explosion-proof motor.

Flashlight Bulb Extension Reaches Cramped Places

For the machinist and tool operator who needs a closely spotted light in hard-to-see places, a novel flashlight bulb extension has been developed by Sierra Aircraft Co., Sierra Madre, Calif. Internal bores on a lathe or boring mill, inside of a gear train, spaces under machines, and interiors of equipment such as tanks, barrels, motors, etc., are all easily illuminated with this device.

Available in lengths from 6 to 36 in., the extension has a plug which



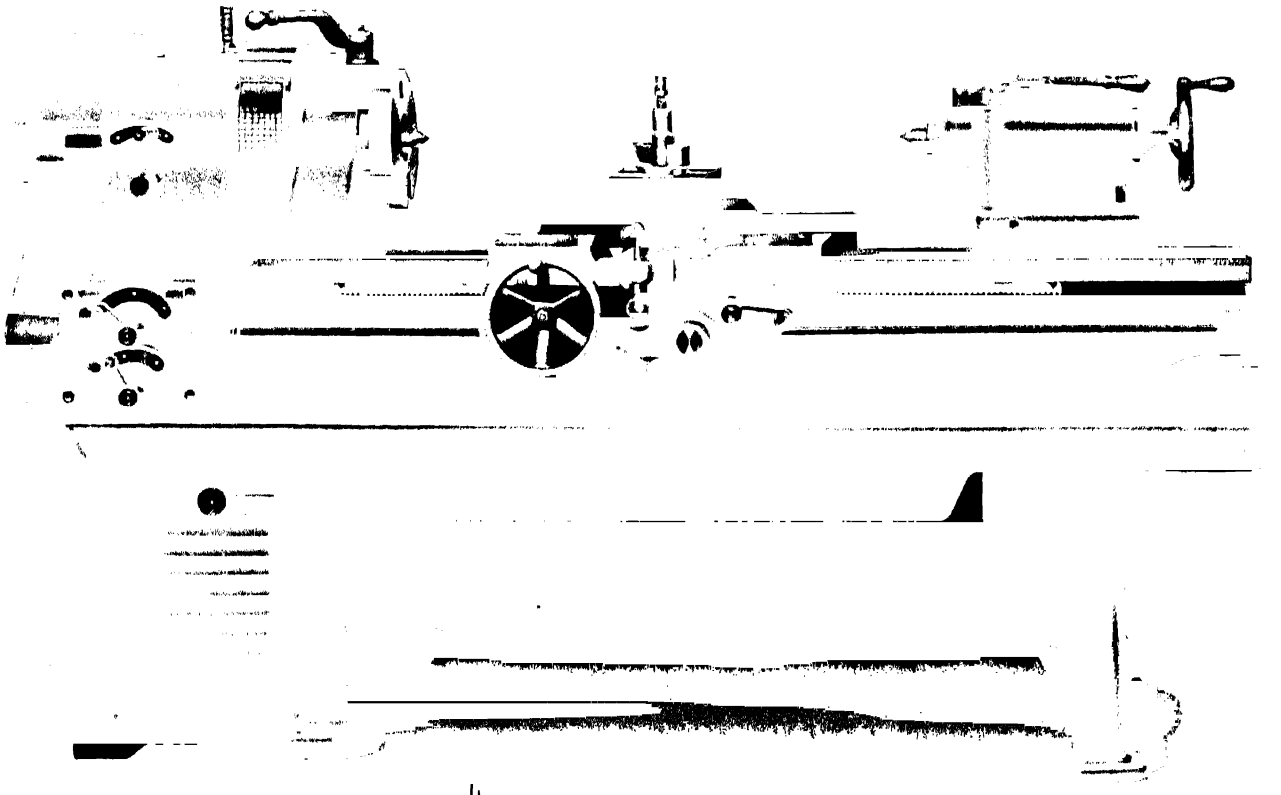
will screw into any flashlight and a socket accommodating the bulb on the other end. Made of high quality aluminum, it is extremely flexible.

"Wrigraph Industro" Drafter Fits Drawings 24 x 36 In.

A completely adjustable ball-bearing drafting machine for drawings up to 24x36 in. has been made available by L. G. Wright, Inc., 5209-4 Euclid Ave., Cleveland, Ohio. Marketed under the name of "Wrigraph Industro" Drafter, this unit is a precision instrument which can be clamped to any drawing board up to two inches thick and 36 in. wide.

The machine has a hinged mounting, permitting it to be raised clear of the board. A leveling screw is provided to adjust it to the plane of the board. It is equipped with exclusive eccentric adjustments through

Here's the NEW 16" and 18"
FEDERAL MANUFACTURING LATHE



Available for Immediate Shipment

●

CONDENSED SPECIFICATIONS

Swing over ways: 18" and 20" for 16" and 18" models respectively.
Minimum distance between centers, 32"—6 bed.
Spindle speeds: 6; range: 75 to 375 R.P.M.
Feeds: cuts per inch: .010 to .100.
Net weight: 16" 2850#; 18", 3000#.
Export Shipping Weight: 16", 3350#; 18", 3500#

..offering tried and proved modern features for fast, accurate work

All details have been designed and developed for maximum productivity and accuracy in boring and turning—to simplify operation and insure low cost.

Selective speed type headstock provides six speeds and is flood lubricated. All spindle speeds are obtained by manipulation of two conveniently located levers.

Spindle runs on Timken Bearings; gears are of heat treated and hardened chrome nickel alloysteel.

Bed of inverted "V" type design is heavily constructed and cross braced for utmost rigidity; apron is of single piece construction, cross braced and accurately tongued to carriage.

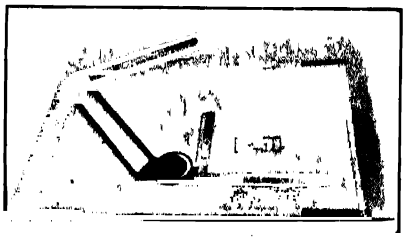
Two change levers control nine feed changes.

Drive is through vee belt from constant speed, completely enclosed motor located in base of head.

Investigate these and other modern features which are fully described in bulletin sent promptly on request.

GERARD MACHINE COMPANY, INC.
60 Park Place, NEWARK, N. J.

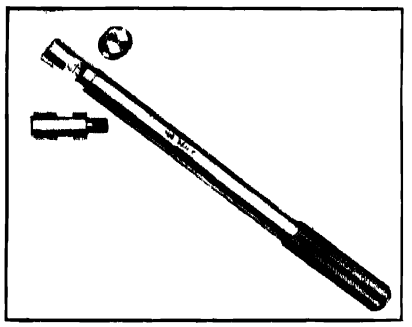
which the machine is calibrated and accuracy controlled Arms are of special rolled channel steel giving great rigidity Protractor head is controlled with the left hand, and the new design features a "no-set" zero



A ½-deg. vernier equipped with a magnifier provides quick and accurate setting of all angles Transparent-edge engine-divided scales touch the drawing paper at front and rear edges only Four models are available

Nielsen Layout Punches Mark Holes Through Sections

Transferring drill holes through drilled sections is made possible by the layout punches offered by Nielsen Tool & Die Co, Berkley, Mich Available in diameters from 17/64 to 59/64 in, these punches are made with case-hardened tips which are removable for replacement When a solid blow



is struck on the punch head, they transfer the drill center and drill circle with complete accuracy

This method is an extension of the procedure used in transferring blind screw and stud holes with transfer screws Among the advantages claimed for its use are its availability for either new or old work and the impossibility of layout marks becoming lost because of drill or drilling fluids erasing the markings Center and drill circle penetrate steel to a depth of about 0 010 in

Miniature Respirator Gives Added Convenience

A respirator so small that it can be carried in the vest pocket has been developed by H S Cover, South Bend, Ind Identified as the "Dupor" No 1 this respirator weighs only 1 oz It can be slipped on and off as readily as a pair of spectacles Wearer can talk, eat, sleep, smoke, without the necessity of removing it, thus assuring protection at all times

Nose piece is of soft pliable rubber which is said to make an air-tight fit over any shape nose Filter is folded so that 9 sq in of filtration area is provided. Filters are easily changed Inhalation valve keeps wearer from re-breathing stale air, and patented bulb valve exhausts

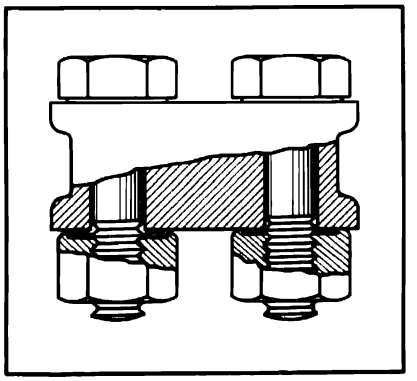


breathed air without allowing unfiltered air to enter Respirator is so small that it does not interfere with vision or with goggles or glasses No metal is used in its construction making it practically unbreakable

One Piece Lock Nut Uses New Principle

A self-contained one-piece all-metal lock nut developed by An-Cor-Lox Div of Laminated Shim Co, 64 Union St, Glenbrook, Conn, utilizes a new locking principle to effect positive locking of the nut

By this principle the nut is locked to the bolt instead of to the work The nut is simply spun on the bolt

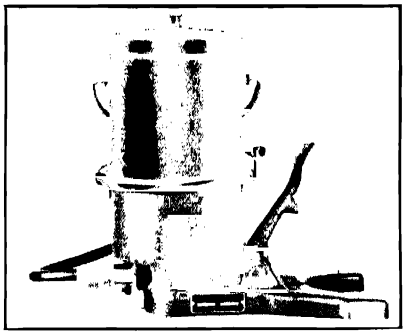


and drawn up to the desired degree of tightness It locks itself automatically to the bolt The metal locking ring at the bottom of the nut is expanded by the locking pressure into the root of the bolt thread and against the nut rim This lock joint holds securely under all conditions of heat and vibration No special length of bolt is required The An-Cor-Lox nut is claimed not to damage the bolt thread nor to mar the surface of the work The same nut can be used over and over without loss of locking efficiency

Alemite Foot-Operated Gun Lubricates Industrial Units

Especially adaptable for lubricating many types of industrial equipment, the Model 6697-A low-pressure volume delivery foot gun has been developed by the Alemite Div of Stewart-Warner Corp, 1826 Diversey Parkway, Chicago, Ill

Gun has a capacity of 25 lb, and pumps approximately 1 cu in of grease per stroke Maximum pressure when

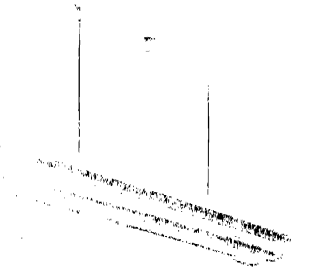


operated by hand is 3,000 lb, and when operated by foot 5,000 lb It weighs 39 lb and stands less than 20 in high It is easily carried about and is provided with a broad flat base for immediate positioning It is particularly suitable for lubricating gear boxes on large industrial equipment

Fluorescent Drafting Lamps Provide Direct-Indirect Light

"Tru-Co-Lite" fluorescent lighting units designed by Edwin F Guth Co, 2615 Washington Blvd, St Louis Mo, are said to provide a type of lighting equivalent to combination direct and indirect illumination, which is especially suitable for drafting and other close work

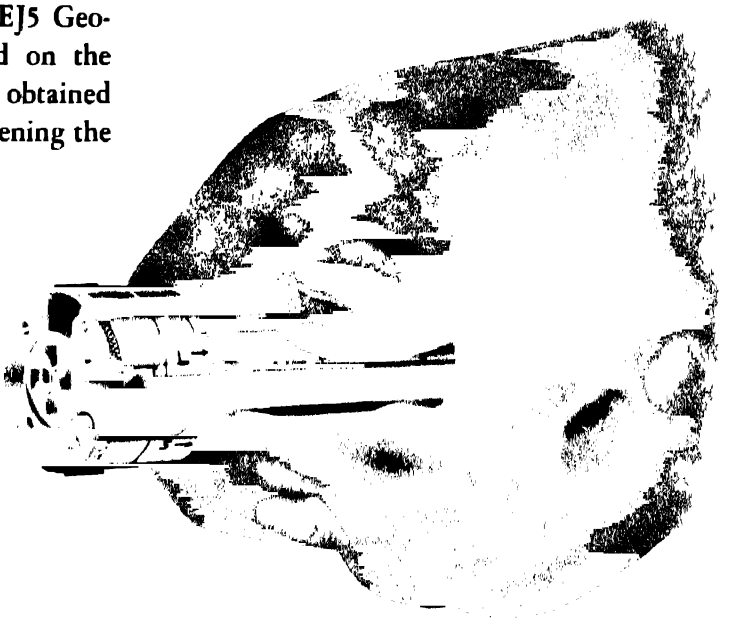
Fixture is sturdily built with reinforcing cast aluminum ends Aluminum reflectors finished by the Alzak process deliver 85 per cent downlight



103,000 PIECES

Without GRINDING CHASERS

When using solid dies, this particular customer averaged only 13,000 to 15,000 pieces per die. But by putting a 3/16″ EJ5 Geometric Solid Adjustable Die Head on the same job, on the same machine, they obtained 103,000 pieces without even resharpening the chasers.



Do You Want A Copy?

NEW BOOKLET

Just off the press is a new booklet on this $\frac{3}{16}$″ EJ5 Removable Chaser Die Head. A copy of this EJ5 booklet will be sent you on request.

The illustration above shows actual size, the 3/16″ Style EJ5 Solid Adjustable Die Head. Only one inch in diameter, this tool will cut small diameter, fine pitch threads smoothly, accurately and economically.

The threading range is from No. 0 to No. 10 diameters inclusive, in pitches as fine as 100 threads per inch. Because the chasers are adjustable within the head, you can cut the desired decimal pitch diameter. The fact that the chasers are removable means easy and quick resharpening—plus a long total chaser life.

Couldn't you use such a tool on your work? Complete details on request.

THE GEOMETRIC TOOL COMPANY

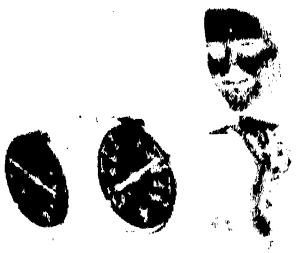
NEW HAVEN, CONN.

Specialists in threading tools since 1895.

with wide light distribution, and 15 per cent uplight for ceiling illumination. Unit is available for four 40-watt lamps or four 20-watt lamps. It is wired complete with 95-100 per cent power factor accessories.

Safety Goggles for Gages Developed by Ashcroft

Safety is the most important of several features of the "Durafront" plastic gage cover developed by Ashcroft Gage Div of Manning, Maxwell & Moore, Inc, Bridgeport, Conn These plastic gage fronts are said to eliminate all possibility of work-

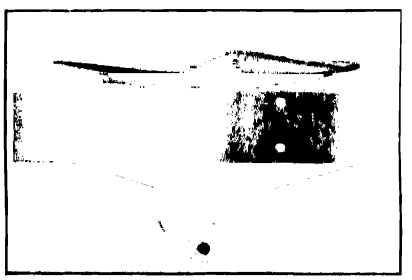


ers being injured by broken or flying gage glass. They are molded of crystal-clear plastic having a tensile strength of 5,000 lb. and a compression strength of 15,000 lb. Said to increase visibility of gages and at the same time improve appearance, they are available in 3½, 4½, and 6 in. sizes, and can be added to any plastic gage now in service.

"Truflo" Roof Fans Increase Air Removal

Truflo Fan Co., 557 Main St, Harmony, Pa., has developed a line of roof ventilating fans recommended where it is necessary to increase air removal in gravity type ventilators, or when wind velocity is not sufficient to ventilate the building.

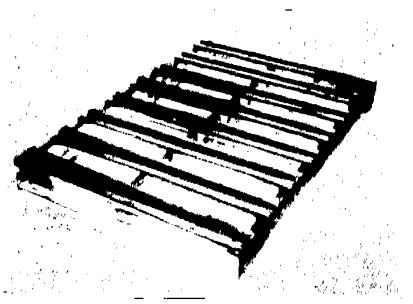
These fans are available in 18, 24,



30, 36, 42 and 48 in. sizes, with exhaust capacities ranging from 2,000 to 40,000 cu.ft. per min. Propellers are of high-quality cast aluminum alloy. Motors can be had in open, totally inclosed, totally inclosed fan cooled, and explosion proof types.

Palmer Shile All-Steel Pallets Constructed With Sectional Faces

A sectional-face all-steel pallet for use with fork trucks has been developed by Palmer Shile Co., 7100 W. Jefferson Ave., Detroit, Mich. Contrasted to the standard practice of using a solid face of corrugated steel, this pallet is made up of 6-in channels with a heavy corrugated center

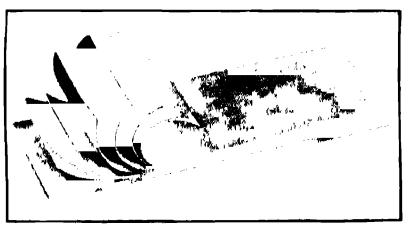


rib. The formed sections are stronger and allow use of lighter gage material, with an accompanying saving in weight.

This type of pallet is practical for use with hand fork trucks. Opening between sections is of sufficient width, on the bottom face, to allow small roller wheels to touch the floor.

"Fabco" Power Belting Has Multiple Plies

Available from Fabreeka Products Co, Boston, Mass., "Fabco" power belting is said to be the first belting priced for general-purpose power transmission to offer the advantages of multiple thin-ply construction This type of construction gives the belt extremely high flexibility, and per-

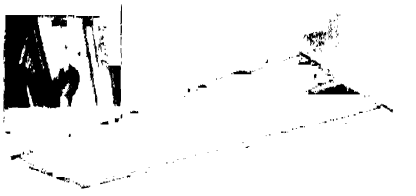


mits it to withstand successfully severe distortion in passing over small pulleys. As a consequence, longer service without takeups and with smoother operation is claimed.

"Sealed-Flo" Lighting Fixture Protects Lamps from Dirt

The "Sealed-Flo" fluorescent lighting unit offered by Benjamin Electric Mfg Co, 120-128 S. Sangamon St., Des Plaines, Ill., features a sealed cover construction which not only protects the lamps and reflecting surfaces from dust and dirt, but also extends the use of fluorescent lighting to locations requiring vapor-proof and dust-tight fixtures.

Protective cover with which the



units are equipped is specially constructed to permit easy servicing. Cover is hinged to lamp housing and locked in place by hand-operated cover clamps. When opened, it hangs straight down for easy servicing. This unit is recommended for locations where lighting equipment is subject to the most adverse atmospheric conditions, such as steam, dampness, noncombustible dusts and vapors. Units are available for either two or three 48-in. fluorescent lamps.

Improved "Jetalizing" Process Protects Steel Surfaces

Hanson-Van Winkle-Munning Co, Matawan, N J., has announced an improvement in the "Jetal" process for applying a black corrosion-resistant finish to steel The process has been changed to a two-bath system which yields a deeper black coating and at the same time permits simpler manipulation and control of the solution.

All steels, except those high in nickel or chromium, can be colored black by the process. Cast iron and some special steels may require deviation from the routine procedure. Only two tanks of ordinary iron or steel are required, along with another tank for the rinse bath. Time required for the dips varies with the class of work, but in general ranges from about 2 to 5 min in each tank.

Milburn Ointments Give Skin Protection

A series of creams and ointments have been developed by Milburn, 905 Henry St., Detroit, Mich., to provide industrial skin protection. They are compounded to apply an extra layer or coating, consisting of ingredients that are insoluble in the specific chemical or chemicals to be combated. There are three major classifications. "Ply" Nos. 1 and 2 are applied like vanishing cream, while "Ply" No. 6 is of the ointment variety. "Ply" No. 1 is used for protection against dirty grease and oil, paint in all forms, asphalt, tar, printing-ink, greases, waxes and pitch. Protection against petroleum products, cooling lubricants and cutting compounds is furnished by "Ply" No. 2. "Ply" No. 6 is for protection against acids.

Tamms Layout Dope Will Not Rub Off

Tamms Silica Co., 228 N. LaSalle St., Chicago, Ill., has developed a layout dope especially suitable for tool and die makers' use. Known as "Tamms Blue Layout Dope," it comes in liquid form ready for immediate use. It is blue in color, quick drying and will not rub off. The scribe or layout tool shows a clear, distinct line without chipping or scraping.

Two Union Steels Are Exceptionally Free Machining

Union Drawn Steel Div. of Republic Steel Corp., Cleveland, Ohio, has announced a Bessemer screw steel and an open-hearth screw steel claimed to be superior in machining qualities to the finest and fastest screw steels previously available, and to be superior in soundness and freedom from machinability variations. Developed to overcome deficiencies in other fast-machining steels, it is claimed that bar after bar of the new steels can be machined at highest speeds with a fine surface finish without reduction in tool life.

The new uniform fast cutting Bessemer steel, Union "Maxcut," has physical properties comparable to S.A.E. X 1112. Parts show a smooth fine finish when machined at 280 ft. per min. with a feed of 0.0095 in., giving an average tool life of more than eleven hours. "Maxcut" responds to cyaniding and other case-hardening processes in a manner similar to S.A.E X 1112.

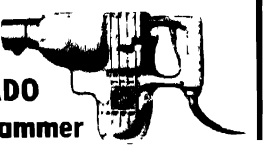
Union "Multicut," the open-hearth steel, has physical properties similar to those of S.A.E. 1115. Parts show a fine finish when machined at 275 ft per min. with a feed of 0.0087 in., giving an average tool life of better than eight hours. "Multicut" can be carburized and hardened to a minimum case hardness of 60 Rockwell C., with either single or double quench. It produces a tough ductile core with a minimum of distortion.

"Miccrolac" Coating Protects Natural or Plated Finishes

Michigan Chrome Co., 6340 E. Jefferson Ave., Detroit, Mich., has developed a coating material known as "Miccrolac" to be used to protect and beautify metal surfaces of either natural or plated finishes.

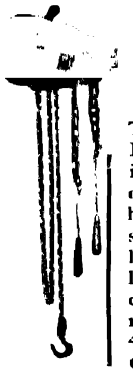
This medium is almost perfectly clear, and dries to a high lustre. It is said to dry exceptionally fast, the type of coat applied for ordinary decorative work drying in only a few seconds' time. It offers excellent qualities of adhesion, flexibility and abra-

Here's "1-Square" VALU ... from a "One-Call" Source



THOR-NADO Electric Hammer

"Slingshot" drive of this new hammer gives "a more powerful blow than any electric hammer of comparable capacity, size and weight". Meets heavy-duty needs in work on stone, wood or metal. Write GRAYBAR for folder giving full specifications.



QUIK-LIFT Electric Hoist

The Coffing "Quik-Lift" can be plugged into any AC or DC circuit connection. Has heavy-duty motor. Sensitive control permits load to be raised or lowered to a fraction of an inch. Range of models from 250 lb. to 4,000 lb capacity. Write GRAYBAR for details.



TWIST-LOCK Cord Connector

Portable tools and other leads need this "sure-power" connecting device. Plug it in, give it a twist and it's locked in place. Built by Hubbell to stand up under "slam-bang" usage in the shop. Ask GRAYBAR for details on the full line of Twist-lock receptacles, caps and other wiring devices.

SIMPLEX Cord, Cable

A tough "armor" of selenium rubber gives this cord extra strength to resist crushing, abrasion, tearing. Assures uninterrupted service from portable tools. Available in a wide range of sizes including cables for big industrial loads. GRAYBAR offers literature, samples.

When you go to GRAYBAR for electrical tools and accessories, you're sure of getting a product that's built to *stay in service* ... one that meets GRAYBAR'S strict standards for electrical applications that must stand up under "slam-bang" shop conditions. What's more, because GRAYBAR sells *everything electrical*, you get the extra convenience of a "one-call" source of supply for related items. Cord, connectors and wiring accessories match up in performance with the equipment they're bought to serve on. Whatever your electrical needs, check with GRAYBAR today!

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50 Union St., Glenbrook, Conn.

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sion resistance. It also provides resistance to sulphur dioxide, sunlight, moisture, oil, grease, gasoline, and all commonly encountered chemical fumes, and does not blush even in the most humid weather.

A unique feature of the material is that it is not to be mixed with thinner, as has been the usual practice with similar lacquers. It is used exactly as it comes from the container. It is accurately adjusted for viscosity and total solids to insure uniform results. It can be applied either by spraying or dipping, and if desired can be brushed on small parts.

TRADE PUBLICATIONS

BELTING Graton & Knight Co., Worcester, Mass., is circulating a catalog on transmission belting, including information on belt dressing and cements.

BORING HEADS C. C. Craley Mfg Co., Shillington, Pa. has issued an 8-page booklet describing off-set boring heads.

CARBIDE TOOLS & DIES A 12-page booklet recently issued by Carboloy Co., Inc., 11185 E. 8 Mile Rd., Detroit, Mich., describes the application of carbide tools and dies.

DIE ACCESSORIES Rolled Thread Die Co., Worcester, Mass., has issued a stock list of dies and accessories.

DIE STEELS Application for die steel is described in an 11-page booklet circulated by Jessop Steel Co., Washington, Pa.

ELECTRIC TOOLS Illustrated Catalog 41 circulated by Skilsaw, Inc., 5033-43 Elston Ave., Chicago, Ill., includes a price list on electric tools and their accessories.

ELECTRODES A folder describing the application of stainless steel electrodes is being circulated by Crucible Steel Co. of America, 405 Lexington Ave., New York, N. Y.

FILES Bulletin R6-40 describes a simplified classification of files and rasps offered by the National Bureau of Standards, U. S. Department of Commerce, Washington, D. C.

GAGES Bulletins Nos. 153, 154 and 155, circulated by Baldwin-Southwark, Division of the Baldwin Locomotive Works, Philadelphia, Pa., illustrates the application and construction of testing equipment.

HYDRAULIC CYLINDERS Bulletin No. 35-B circulated by Hannifin Mfg. Co., 621–631 So. Kolmar Ave., Chicago, Ill., discusses an improved type of high pressure hydraulic cylinders for power applications.

JACKS Machinists' and planer jacks are discussed in Bulletin 303 issued by Templeton, Kenly & Co., 1020 S. Central Ave., Chicago, Ill.

JIG GRINDERS A four-page folder circulated by Marburg Bros., Inc., 90 W. St., New York, N. Y., illustrates the construction of jig grinders.

LATHES Pratt & Whitney Div., Niles Bement-Pond Co., Hartford, Conn., has issued a 24-page illustrated bulletin describing the P&W Model C lathes.

METAL THICKNESS A leaflet issued by Kocour Co., 4724 S. Christiana Ave., Chicago, Ill., discusses a method of determining the thickness of electro-deposited metals.

MOTORS Bulletin No. F-8548, describing a.c. and d.c. fractional horsepower motors has been issued by Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

NICKEL ALLOYS A 16-page guide to the uses and properties of nickel alloys has been published by the International Nickel Co., 67 Wall St., New York, N. Y.

OILERS Bulletin No. 10, circulated by Gits Bros. Mfg. Co., 1846–62 So. Kilbourn Ave., Chicago, Ill., discusses sight gravity and wick feed oilers.

PORTABLE GRINDERS Norton Co., Worcester, Mass., has issued a 21-page booklet which describes grinding tools with portable equipment.

SAFETY EQUIPMENT The Boyer-Campbell Co., 6540 Antoine St., Detroit, Mich., describes equipment for eye, face and head protection, machine tool guards, etc., in its Catalog 40.

SMALL TOOLS Two pamphlets issued by Reed Small Tool Works, Worcester, Mass., lists prices and sizes of knurls and micrometers.

SPUN HEADS A 132-page manual covering various types of spun heads has been issued by Lukens Steel Co., Coatesville, Pa.

STARTER—Type CR7006-D50 magnetic starters are described in a four-page illustrated folder, No. GEA-3250, issued by General Electric Co., Schenectady, N. Y.

STEEL CUTTING Bulletins Nos. G-401, 402, published by Fansteel Metallurgical Corp., North Chicago, Ill., describe welded tip and brazed tip tools for cutting steel.

STEEL PRODUCTS Joseph T. Ryerson & Son, Inc., 203 Westside Ave., Jersey City, N. J., has published a guide to large and diversified stocks of steel and allied products available for immediate shipment.

TAP SHARPENERS "Hybco," a precision tap sharpener, is described in a 6-page pamphlet circulated by Henry P. Boggis & Co., 410 West Lakeside Ave., Cleveland, Ohio.

TRANSMISSION EQUIPMENT Boston Gear Works, Inc., North Quincy, Mass., describes a complete line of power transmission equipment in Catalog 53.

TURRET LATHES Gisholt Machine Co., Madison, Wis., has published a 24-page booklet illustrating standard tools for high production turret lathes.

NEW BOOKS

MATERIALS OF CONSTRUCTION —*By the late J. B. Johnson, rewritten by M. O. Withey, Professor of Mechanics in the University of Wisconsin, and James Aston, Consulting Metallurgist, A. M. Byers Co 867 pages. Published by John Wiley & Sons, Inc., New York, N. Y. $6.*

This eighth edition of Johnson's "Materials of Construction" incorporates extensive revisions; much of the statistical data have been brought up to date. The first three chapters have been revised to include new definitions, column formulae, formulae for strength and deflection of flat plates, information on elastic break-down, new testing machines and apparatus, and improved methods of testing. In the chapters on timber, information on termites, plywood and joint fastenings and new grading rules for structural timbers are presented.

Well known as a text and as a reference book during the forty years that have passed since Dean J. B. Johnson prepared the first edition of "Materials of Construction," this new edition will be even more useful to students and engineers requiring a knowledge of the mechanical properties of materials employed in construction.

The authors of the eighth edition have consistently maintained the broad scope of previous editions. Their aim has been to provide the essential information concerning the sources, manufacture or fabrication of the principal materials; to give carefully selected data covering the more important mechanical and physical properties, and the influences of various factors upon these properties; to show the causes of defects and variations and how they may be discovered; to furnish and acquaint them with the technique of testing materials; and to present to the students some of the more general uses of the different materials. Diagrams and charts are used in presenting facts and laws. Tables have been omitted wherever possible, just as in previous editions.

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DEVELOPED FOR USE ON THE DOALL CONTOUR MACHINE, THE WORLD'S FASTEST PRECISION SHAPE CUTTING MACHINE TOOL

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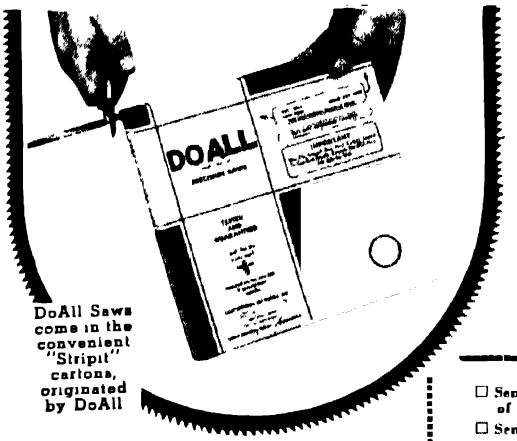
S.A.E. 3150 heat treated to 33-39 C Rockwell
Laminated Low Carbon Steel Sheets
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Roller Bearings
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Semi-steel Castings
Grade "C" Piping



Poor Chips from other saws.



Curled, Clean DoAll Cuttings



DoAll Saws come in the convenient "Stripit" cartons, originated by DoAll

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DO ALL SAWS

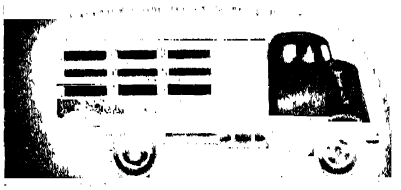
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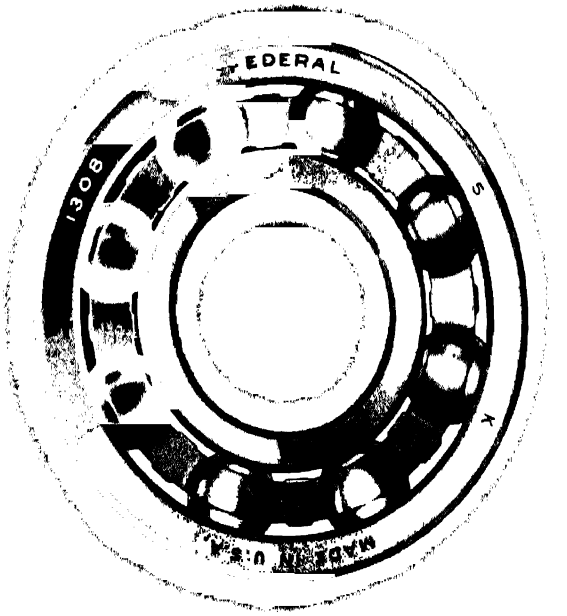




D R A

BEARINGS





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Makers of Fine Ball Bearings

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HARRISON

HARRISON RADIATOR DIVISION
GENERAL MOTORS CORPORATION

LOCKPORT NEW YORK

July 24, 1940

American Machinist
330 West 42nd Street
New York, New York

ATTENTION: Mr. Burnham Finney, Editor

Gentlemen:

With reference to your letter of July 19th, I am quite satisfied with the American Machinist the way it is written. I am interested in all mechanical processes and progress, whether or not I can use the information directly in my work.

I probably get the most direct use out of the advertising and the descriptions of new machinery and equipment.

Yours truly,

HARRISON RADIATOR DIVISION
GENERAL MOTORS CORPORATION

Leo C. Shippy
Tool Superintendent

LCS:CMR

RADIATORS HEAT EXCHANGERS OIL TEMPERATURE REGULATORS THERMOSTATS HEATERS

WHAT'S IN THIS ISSUE

ALUMINUM AGE?

"Why don't they make it out of aluminum?" All through school, while we were under the delusion we would soon show Detroit how to make automobiles, we asked ours if that question. The thought of lugging around dead weight in everything from vacuum cleaners to box cars made our blood boil. Sheer waste, that's what it was. Sheer waste.

Since then we have been happy to note the increasing use of lightweight materials for all kinds of moving equipment. Foremost among these, of course, are the aluminum alloys. Thus it is with real enthusiasm that we recommend the special blue section in this issue. It has been compiled by Mr. Ben C. Brosheer, who you may recall, was responsible for our special section of the working of magnesium last May. He must have kept going on his own momentum, for before the reprints were dry he was half way through another on aluminum. This one, which begins on page 617, is really his masterpiece. It's the biggest we've ever published, comprising sixteen pages jammed with all the data, recommendations and specifications the average metal working firm is ever apt to need. But we realize only too well how many aluminum products are going into aircraft manufacture, so Mr. Brosheer's kept his eye on the aircraft industry in writing the text.

MORE ON MILLING

On page 603 is an article which, it seems to us, no progressive production man can afford to miss. It's one of those detailed accounts that are packed with just the kind of information shop men can use. The subject of this particular one is the grinding of carbide milling cutters. It's the first of two articles by Fred W. Lucht, of Carboloy, on this important subject. In this one Mr. Lucht lays down the fundamentals, in the second he gives more specific recommendations.

BACK TO BATTLE

Seems like we just can't keep our mind off this war. That's propaganda for you. It's also the result of looking over proofs of the article on page



HANS LASKER

606, which is the second on how Republic Aviation boosts production with its as many jigs as possible philosophy. Both articles are by Hans Lasker, Republic's chief tool engineer, who came to Farmingdale by way of Switzerland, Germany and France. He has worked for Chance Vought, Bird Limited, Seversky and Republic. He's been organizer, researcher, estimator, assistant plant manager and chief tool engineer. Which should make him eligible for membership in the A.S.T.I.

PERSONAL INTEREST

We've long had a secret admiration for Monarch Machine Tool, what with its various employee relations policies and activities. Unlike many firms that talk a lot and do little, Monarch really digs down into its pants pockets to smooth the way



D. H. McKELLAR

for its workers. So it's with a somewhat restored faith in human nature that we present D. H. McKellar's story on page 605. Mr. McKellar is Monarch's director of training, and we think you'll be interested in what he has to say about the personal interest Monarch takes in its men.

WHAT, AGAIN?

Yes, again. Short Cuts for the Small Shop by A. H. Waychoff. So popular has this feature become that the powers that be are considering making it a regular department. If you're in favor, use the back of a broken hacksaw blade to let us know. This issue's batch is on page 611.

AND MORE ON MEASUREMENT

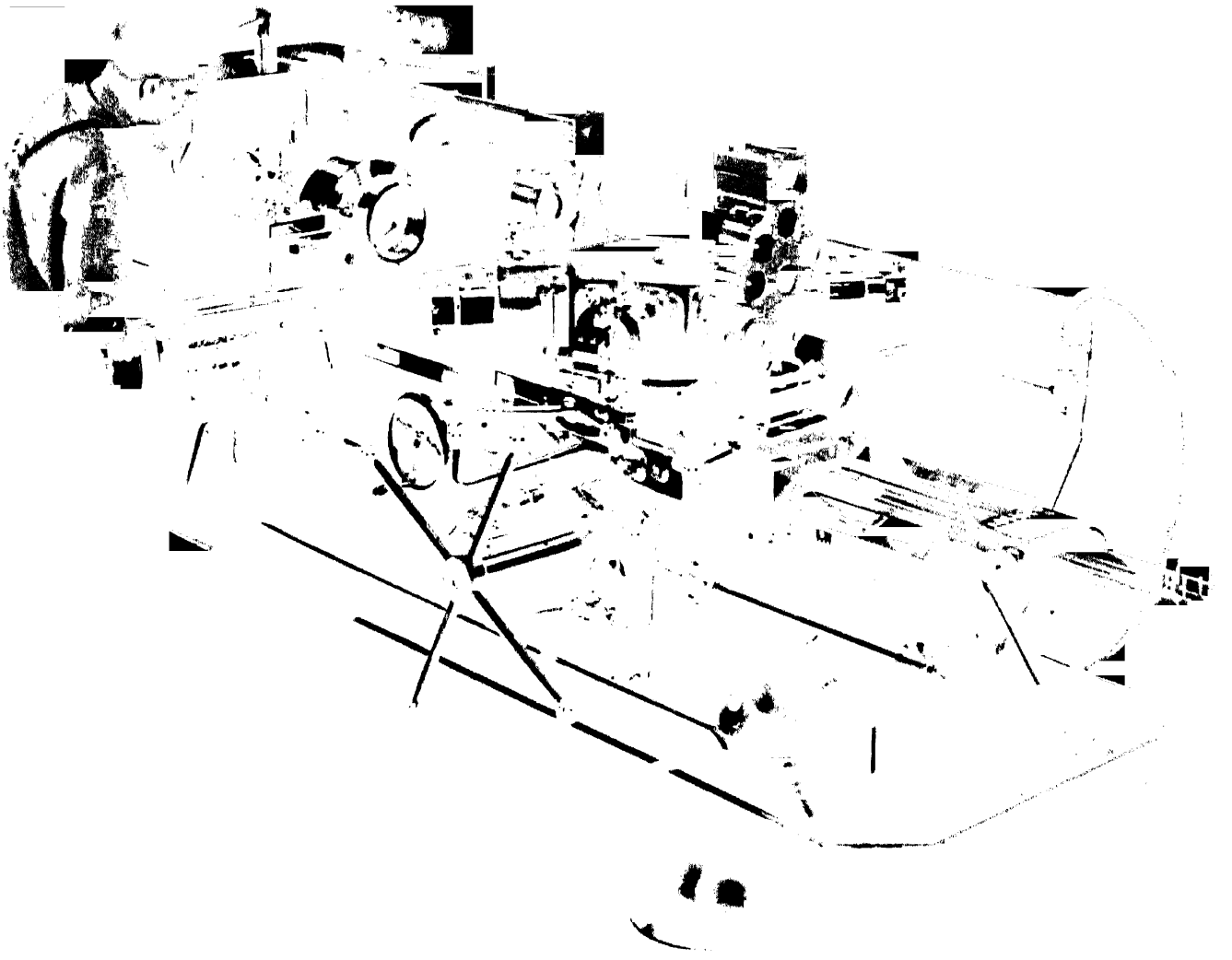
Last issue, you remember, C. C. Street of Federal Products Corporation discussed the fundamentals of measuring, in preparation for an exhaustive series on comparison measurement. This installment, on page 612, takes up where the last one left off, as you may suspect.

KNOCKOUT

For some time we've had the unofficial title of headline thinker upper, the idea being to concoct headlines which would stimulate reading and still make sense. It's quite a problem when you're stumped, even eight beers are no good. But we managed to create (!) one for Herbert Chase's article on page 616 which everyone in the office approved. We hope you will too. If not, write your criticism on the other side of that hacksaw blade.

COMING

You've read a lot about the way various companies make shells. But, so far as we know, there's been precious little published telling how to do the job yourself. So it is with considerable pride that we announce an article on how to make 75 mm shells, which is scheduled for an early issue. Based on Frankford Arsenal's experience, it will comprise twelve pages telling how the job is done, including details of the tooling used.





CINCINNATI

Versatility and Accuracy For Aircraft Turning Jobs

At the Pratt & Whitney Aircraft plant, the Cincinnati Acme Universal Turret Lathe shown above is performing four operations on steel liners for one of the large main bearings of Pratt & Whitney Radial Engines. Turning, boring, facing and chamfering are done on the part in this one set-up.

Cincinnati Acme Universal Turret Lathes are chosen by aircraft manufacturers for Accuracy — to meet the rigid specifications of the industry . . . Versatility—to handle long or short runs on a wide variety of parts. . . . Speed—for profitable high production and for maximum efficiency with carbide and similar tools.

Write for engineering suggestions on any problem of Turret Lathe production.

MACHINE TOOL CO.

Grinding carbide cutters

BY FRED W LUCHT ENGINEER CARBOLOY COMPANY

I—No milling cutter can be expected to produce a good milled surface unless it is ground to the proper cutting angles and then kept sharp

A HIGH QUALITY milled surface may be obtained only when the milling cutter is accurately ground The technique for grinding milling and other multi bladed cutters is simple and can be followed easily when thoroughly understood Of particular importance when grinding cutters tipped with one of the cemented carbides the following suggestions are equally applicable when the cutting edge is made up of some other material

A milling cutter should never be used after it ceases to cut freely because it consumes increasingly more power, produces inferior finish, and ultimately will cease to produce parts of the required accuracy It is false economy to permit the cutter to become dull to the extent that a heavy grind is necessary for sharpening More time is required to resharpen a very dull cutter than one that is only slightly dull, furthermore considerable carbide stock is wasted when resharpening a very dull cutter

Major factors which must be considered when sharpening any milling cutters are the assignment of a trained operator, supplied with complete instructions, the use of the correct type of grinding machine, the use of a tooth rest that can be adjusted accurately, and the use of correct grinding wheels



Size and placement of the tooth rest depends on the type of machine used size of the milling cutter tooth spacing and rake angle of the cutter

Two types of grinding machines suitable for sharpening milling cutters are available today In the first of these the cutter is mounted on the table and is moved past the grinding wheel head which in turn may be set in the desired position The face of the tooth being sharpened is held against the tooth rest mounted on the table In the second type of grinder the cutter is mounted on a stud in the grinding wheel and tooth rest slide past the cutter The face of the tooth being sharpened is held against the tooth rest mounted on the wheel slide and the cutter is allowed to rotate as the tooth follows the rest

The cutter grinder must be kept in first class condition, with a free running, snug spindle, gibs must be snug and the ways must be straight and true For best results, the face of the cutter adapter on the grinder should be ground in position and if removed for any reason should be reground in position before using

The ideal grinding cycle for reconditioning a cutter requires the following types of wheels

1 A silicon carbide plain wheel of

about 80 grit (like Carborundum G 80 RW or Norton 3480-17) is used for the rough cylindrical grinding of the carbide and steel on the periphery, chamfer and side of the tooth. Wheel speed for this operation, and for those which follow, will range from 2,700 to 5,500 ft. per min. Wheel in-feed per pass for this rough cylindrical grinding operation should be about 0.002 in.

2. A 60 grit silicon-carbide cup wheel (like Carborundum G 60 RW or Norton 3160 17) with a 20 deg. beveled face is used for the rough back-off grinding of the carbide and steel on the periphery, chamfer and side of the cutter tooth. As in the first operation, a wheel in-feed of 0.002 in. per pass is satisfactory for most jobs.

3. A 120 grit silicon-carbon cup wheel (like Carborundum G-120 SW

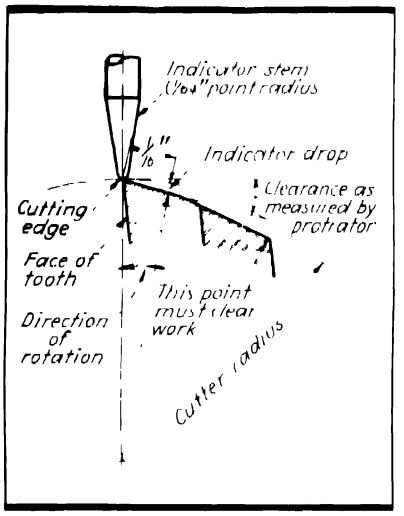


Fig. 1—When clearance angle is determined by a protractor the heel of the tooth often will rub the work—best practice is to measure the indicator drop $\frac{1}{16}$ in. back of the cutting edge

or Norton 3 11 20 H7) may be used for finish grinding on the carbide tip only, where the finish on the part to be milled does not have to be held to an extremely fine surface. To prevent overheating of the carbide tips, the silicon-carbide wheel should have a 20 deg. bevel up to a $\frac{1}{16}$ in. wide face. Wheel in-feed per pass for the finish back-off operation on the carbide tip should be about 0.0003 to 0.0005 in.

4. A 220 grit, resinoid bonded diamond wheel of the 20 deg. flaring cup type may be used for finish grinding the carbide tip only, where the finish on the part must be very smooth. In order to keep the run-out on the periphery of the diamond wheel within 0.0005 in. it is recommended that the wheel be mounted on an adapter and not removed from the adapter until worn out. In this way the diamond wheel can be mounted on the spindle quickly, and will maintain its true running characteristic. A wheel in-feed of 0.0003 in. to 0.0005 in. per pass also is recommended for this operation.

The cutter should be fed across the grinding wheel by hand, as it gives the operator the feel of the wheel cutting at all times. Machine feeding is not recommended. The hand feed should be steady, and a rate of approximately $\frac{1}{4}$ in. per sec. Bond and hardness of wheel are important in each of the operations listed above.

In order to maintain a constant clearance angle behind the cutting edge, a tooth rest should be used to guide the grinding wheel along the cutter tooth or the cutter tooth along the wheel, depending on the type of machine used. The tooth rest should be made of hardened steel and should have a rigid cross-section. The size and shape of the rest depends entirely on the tooth spacing and the rake angle of the cutter. It should be arranged to give rigid support to the cutter.

The point of contact of the tooth rest should always be on the face of the tooth being sharpened. Clearance between the grinding wheel and the tooth rest should not be greater than $\frac{1}{32}$ in. The tooth rest should project beyond the cutting edge on the periphery of the grinding wheel for the purpose of guiding the tooth up to the point where the grinding starts. The leading edge of the tooth rest must clear the face of the tooth just before the wheel begins to cut.

Table 1—CLEARANCE ON MILLING CUTTERS

(Expressed in Thousandths of an Inch Drop $\frac{1}{16}$ in. Behind Cutting Edge)

MATERIAL	*Suggested Clearance On Carbide* On Periphery	On Side of Tooth
Aluminum	0 008 0 009	0 005 0 0065
Brass & Bronze Hard	0 005 0.006	0 003 0 004
Brass & Bronze - Soft	0 0055-0.0065	0.0035-0.0045
Cast Iron, Hard and Medium	0.005 0.006	0.003 0.004
Cast Iron, Soft; also Semi Steel	0 0055 0 0065	0 0035-0.0045
Copper	0.008 0 009	0 0055 0 0065
Fiber	0.008 0 009	0 0055 0 0065
Malleable Iron -- Hard	0 005 0 006	0 003 0 004
Malleable Iron -- Medium Soft	0.0055 0.0065	0.0035 0 0045
Plastics	0.008 0 009	0 0055 0 0065
Rubber Hard	0 008 0 009	0.0055 0 0065
Rubber Medium	0 010 0 011	0.0065-0 0075
Steel Carbon and Alloy	0 007 0.008	0.004 0.005
Steel Cast	0 0055 0 0065	0 0035 0 0045
Zinc Alloy Die Castings	0.009-0 010	0.006-0.007

Note: Add 0.002 0,005 in. to the " On Periphery " values shown above to obtain " rough back-off " tooth rest setting in Table II (see the second part of this article).

Correct clearance angle back of the cutting edge on the blade is essential. Teeth with insufficient clearance will drag over the work, causing friction which will result in poor finish, slow cutting and rapid tool dulling. Too large a clearance will tend to produce chatter and will result in rapid tool wear.

When the clearance angle is measured by a protractor it often is found that the cutter has insufficient clearance, especially for cutters 3 in. in diameter or smaller. This results in rubbing and rapid breakdown of the cutting edge. The best way to obtain the correct cutting clearance is by measuring the indicator drop in thousandths of an inch $\frac{1}{16}$ in. behind the cutting edge, as shown in Fig. 1, instead of by taking a protractor reading.

Measurement of the clearance angle with an indicator does not mean that

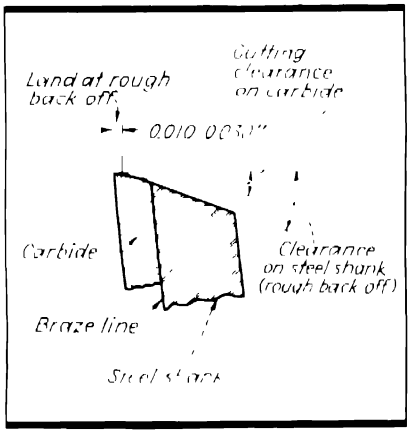


Fig. 2—Cutter tooth clearance angles produced by rough back-off and finish grinding operations are indicated above. For carbide-tipped blades, the clearance angle should run up to the cutting edge

the grinder set up is more complicated Actually this method eliminates cut and try in the setting and in the measurement of the clearance Knowing the desired drop in $\frac{1}{16}$ in is shown in Table I it is necessary only to take this value and refer to Table II which will be given in the second part of this article from which is read the correct tooth rest setting to produce the desired clearance Accurate results are obtained with this simple procedure

The clearance angle is produced by properly locating the wheel the cutter and the tooth rest There are several methods of accomplishing this depending upon the type of wheel used the shape of the cutter and the location of the tooth rest Taking these three factors into consideration any experienced grinder hand can set up a grinding machine that will produce the desired clearance angles In Fig 2 are shown the elements of the milling cutter tooth and the angles produced when sharpening The correct grinding procedure for carbide tipped milling cutters will be discussed in part two of this article

This plant didn't lose touch

BY D H McKELLAR DIRECTOR OF TRAINING MONARCH MACHINE TOOL COMPANY

Use of modern cafeteria and auditorium retains intimacy of small family at Monarch

WHEN WE EXPANDED our plant recently this year we included a modern cafeteria and an auditorium From a strictly business standpoint they weren't needed But we felt that they would help in retaining among our employees the intimacy of a small family Through their use Monarch would be fulfilling its family and community obligations

Through many years Monarch has had a closely knit organization The titleless office doors were open to employees wives merchants teachers city officials social leaders The result was a healthy relationship between the company and employees and between the company and the various members of the community



At one end of the cafeteria employees can read the newspaper and listen to the radio



Employee department heads up cafeteria line and patrons in the auditorium

We felt that as the company grew it might lose that fine relationship unless measures were taken to prevent it Unfortunately as the number of employees grows the natural tendency is for the men to be less acquainted with each other and to regard the company as merely a place to earn their bread

Use of the cafeteria and auditorium we felt would offset that tendency It would bring the employees closer to each other and closer to the management and after all everyone in Monarch has a vital interest in a common enterprise

Employees use the cafeteria and auditorium for a wide range of activities ordinary lunch time recreation organized dramatic and musical entertainment, educational exhibits special training courses These facilities also are offered to various worthy civic educational cultural and charitable groups No charge is made The demand is so great that rules have been laid down governing use of the cafeteria and auditorium Among these rules are the following

Needs of the employees take precedence over those of public groups No intoxicating beverages may be consumed all games must be of the non gambling type all functions must be free from religious doctrine or political flavor Admission may be charged only for activities for charitable purposes no individual or group of individuals shall get any profit Those who wish to use the facilities must apply to the management in writing the management reserving the sole right to grant the privilege



Leading wing edges are jig assembled from spars, press formed nose ribs and templet cut skin. The ribs are lined up vertically by taut wires

Jigs for airplane assembly

BY H. LASKER, CHIEF TOOL ENGINEER, REPUBLIC AVIATION CORPORATION

II—Jigs designed to assure duplication of small and large sub-assemblies simplify later assembly operations. This is the basis of fast production

JIGS FOR ALL plane assemblies—simple structural parts, entire fuselage and wing sections, and complete planes—is one way to speed production. The Republic Aviation Corporation has put this into effect. The more jigs used for each part, the more men can be employed. And the more men employed, the more planes can be made in a given time. Under this plan, Republic achieves many of the mass production features of the automobile industry.

Each Republic plane is divided during manufacture into fuselage and wing groups. The parts of each group constitute a major sub assembly: front, middle and tail sections for the fuselage, and center, outer left hand and outer right hand panels for the wings. These are built up from minor sub assemblies such as spars, ribs, bulkhead or frame rings, longerons, stiffening ties, leading and trailing wing edges, wing tips, flooring, stringers and skin. (*AM*—Vol. 81, page 570.) These minor sub assemblies are made in accurate jigs, and are so drilled and formed that they match within close limits during assembly of the major plane sections.

Outstanding features of the jigs are the small number of fastening points required, and the use of bolts and dowels to hold parts during assembly. Since assembly men have only to handle these bolts and dowels to remove a completed assembly from its jig, all assemblies from each jig are identical. This being characteristic of all jigs, progressive assembly of both minor and major sub assemblies proceeds at maximum speed.

The jigs are built and maintained by expert toolmakers. Men employed on the production lines are trained quickly in the technique of their use.

Aside from component parts of major sub assemblies, jigs are used to make canopies, turtledecks, air scoops, control surfaces, landing gear fairing, fillets, engine mounts, cowling parts, firewalls, instrument panels and covers. Also oil tanks, brackets of all kinds, seats, ammunition boxes and other accessories. Material for these parts may be press formed, stretched, hand formed and otherwise worked, following general sheet metal practice for plane parts. Highly stressed parts are heat treated. Landing gear parts and brackets of all kinds are machined from either forgings or solid metal.

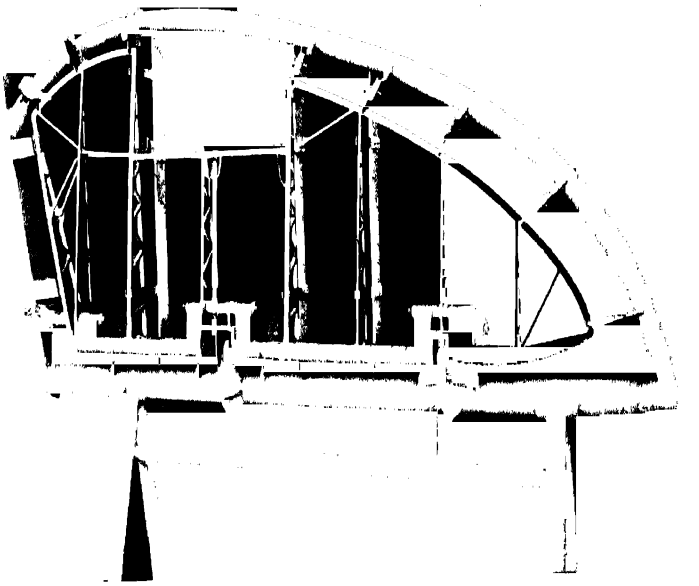
When these parts are completed,

Wing tips are assembled quickly and accurately in these jigs. The brackets on the upper curved member hold the contoured skin sheets for drilling and riveting to the ribs and spars. Pick up holes for preliminary fastening are jig drilled at the splice end of the skin sheets





This rudder jig shows the technique of Republic's assembly practice. It is successful because the jigs are designed to assure exact duplication of sub assemblies



Wing spars are assembled in these jigs which position a built up web between top and bottom flanges. Bottom flanges, rib angles and the web are drilled through holes previously jig drilled in the top flanges and angles





they move to the assembly line The line begins when a center wing panel is attached to a fuselage and the two parts mounted on a rolling jig with attaching points at the center panel and the tail This jig is rolled from station to station when the outer wing panels, power plant, landing gear, tail surfaces, ailerons, flaps, cowling and all appurtenances and appliances are installed

Accuracy of Sub-Assemblies

The success of the assembly line method here described depends on the accuracy of jig assembled parts This accuracy is maintained from the moment flat stock and angles for minor sub assemblies are obtained from the stockroom

Flat stock for ribs spars, bulkhead rings, flooring, wing parts and skin sections are first sheared to approximate rectangular shape A templet which serves as a contour and drill jig, is clamped over six to ten flat sheets Preliminary fastening holes are drilled, bolts inserted and the clamps removed Following the contour of the templet, the sheets are rough cut to shape on metal band saws Final contouring is done on vertical routers, the cutter following its guiding roller which bears against the side of the templet Additional holes are drilled for preliminary fastening points during first assembly operations

Some of the sheets are sent to assembly jigs without further work Other sheets are flanged, pressed, stamped and otherwise prepared for later assemblies The usual bending brakes, presses, nibblers, joggle presses, and draw bench rolls are employed

Extruded angles are cut to desired lengths and drilled accurately in jigs When required, angles are rolled and drawn to match the curved lines of the ship, the contour being held to close limits by templets Offsets are made on joggle presses

The technique of jig work is best exemplified by assembly methods for spars, bulkhead rings leading and trailing wing edges, wing tips, wing flaps, rudders and longerons Jigs for these parts are illustrated

Take the spars, five of which run longitudinally through each wing panel The work done on No 1 spar for the center panel is typical of all spar assemblies

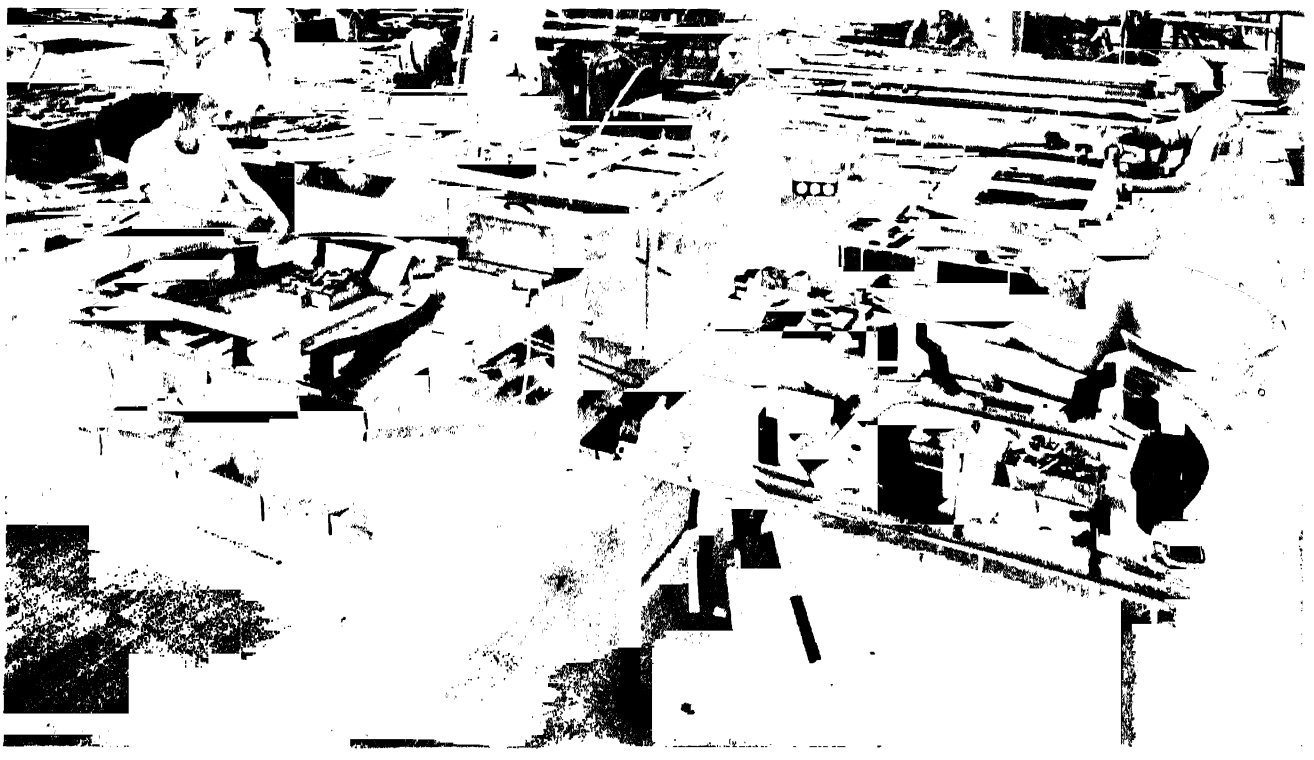
The web is built up from flat plates of various lengths One center plate runs the length of the spar while shorter ones are used at the ends for stiffeners These plates previously routed to exact shape, are clamped together Holes drilled in the top plates serve as guides for drilling the web assembly When drilled the clamps are removed and chips are blown from between the plates They are then temporarily bolted together all holes are reamed preparatory to riveting and the bolts loosened to remove chips When the bolts are retightened the plates are riveted Only the holes necessary for assembly of the web plates are drilled and reamed at this time Those for top and bottom flanges and rib attaching angles are drilled in the jig when assembled to the web

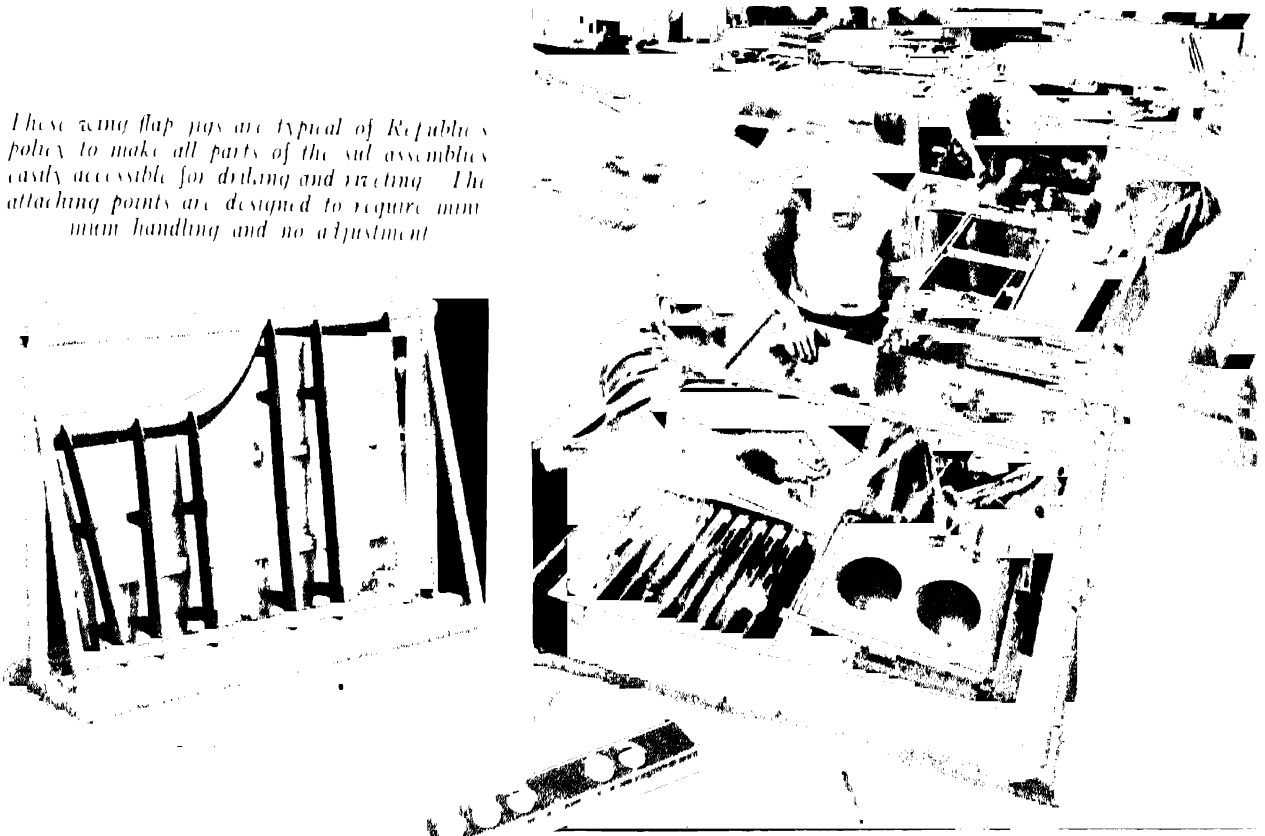
No dowels or fastening bolts are used on the spar jigs Rather the top and bottom flanges with the web between them are clamped to accurately spaced brackets so machined that the flanges and web fit snugly therein prior to clamping When clamped, the bottom flange and web are drilled through holes in the top flange previously jig drilled for this purpose Stiffener and rib attaching angles on both sides of the web are bolted in place and drilled through holes in the top angles two holes were previously jig drilled in the bottom angles for the fastening bolts When all holes are drilled and reamed the fastening bolts are loosened chips are removed, the bolts tightened and the parts spot riveted together The spars are removed from the jigs and machine riveted Later they are replaced in the jig inspected and forged corner brackets are applied

Jigs Simplify Assembly

Bulkhead or frame rings are assembled in much the same manner as spars The jigs made of tubular sections with attaching plates and brackets welded in place are set flat on work benches The brackets require no bolts or dowels to hold ring

Bulkhead rings are assembled from circular flange sections set in attaching brackets around the perimeter of their jigs Web sections and stiffening angles are bolted in place for drilling reaming and spot riveting The jigs are used for inspection after machine riveting the assembly





These wing flap jigs are typical of Republic's policy to make all parts of the sub assemblies easily accessible for drilling and riveting. The attaching points are designed to require minimum handling and no adjustment

Entire floor sections are made from corrugated flanged and press formed sheets. These are placed into position in the angle frames of the jig preparatory to drilling and riveting flanges and stiffeners. The flanges and sheets fit snugly into the angle frames and are not bolted or clamped thereto during assembly

Longerons which carry engine mount reactions into the front fuselage section are jig assembled from press formed sections, flat web sheets, tapered side panels and extruded angles. Pick up holes are drilled to start assembly

sub assemblies since the brackets are machined to the shape of the sub assemblies, however, during preliminary assembly the parts are clamped to the brackets.

The rings are built up from web sheets placed between flanges and stiffeners, however, some of the rings have but one flange. The flanges, semi circular in shape to conform to the ship's lines, are rolled in sections of various lengths. These are assembled around the perimeter of the jig and clamped in place. The web sections, flanges and stiffeners are temporarily bolted in position through pick up holes jig drilled previously. Complete drilling is done in the jig through the top flanges and stiffeners, holes in which were drilled before they were shaped. Before machine riveting the ring assembly, all holes are reamed, chips and burrs removed, and spot rivets are applied.

Leading wing edges are assembled by placing a spar in a jig formed by a horizontal steel tube to which are welded accurately spaced attaching brackets. With the spar resting in the brackets, rib attaching angles are applied to the top of the spar. Nose ribs are drilled through the angles and riveted after being lined up vertically by taut guide wires running through jig members around two end and one center rib. This assembly is shown in one of the illustrations. The skin is bent around the nose ribs, drilled through the rib flanges and removed for dimpling to take flush rivets. When replaced over the ribs, the skin is held by spring fasteners, preparatory to riveting.

Trailing edges are jig assembled in the same manner as leading edges. The jigs are horizontal steel tubes supported by triangular legs imbedded in concrete. Attaching points are spaced to hold rib attaching angles, aileron brackets and flap brackets, all of which are riveted to the spar. Ribs, stiffeners, ties and stringers are assembled in order and drilled and riveted as they are assembled. The skin is drilled, removed for dimpling, replaced, held by spring fasteners and finally riveted. The jigs for the trailing edges with both flap and aileron openings are open and accessible at all stages of assembly.

Wing tips are assembled in jigs with fastening brackets around the edges and angle irons at the outer panel splice. The brackets are welded to a steel tube curved to match the curved end of the wing tip. This tube in turn is welded to a large tubular section supported by triangular legs. Welded to the horizontal member are rounded and tapered angle irons which conform to the shape of the wing section. During assembly the top skin, ribs and bottom skin are applied, each being drilled and riveted in turn, however the skin is dimpled for flush riveting before final assembly.

The foregoing description of jig assembled parts applies in general to assembly of longerons, flaps, rudders and flooring, illustrations of which are shown. The rudder jig in particular shows the technique of Republic's assembly practice. In every instance the jigs are designed accurately to assure exact duplication of sub assemblies. The success of Republic's jig assembly methods is predicated on this fact.

"Learners" trained soundly

Master simple jobs in 12 weeks, develop into specialists in 18 months. Plan can be widely used

THE TRICK of training men soundly for a job in the shortest possible time is something that hundreds of metal-working companies are learning. It is a technique which works. Nowhere has it worked better than at a company in Cincinnati, Ohio, which has taken 1,000 "green hands" the past three years and trained them in a matter of weeks to do a good job. This "learner" plan is adaptable to almost any metal-working plant.

Trainees go through three stages: (1) the theoretical or "tell 'em" stage, (2) the practical application of the "tell 'em" through the "show 'em" demonstration on the machine, and (3) the "do it" stage where the trainee actually does the work.

Applicants for the course are confined to the age group between 18 and 21 years. The company prefers to take boys who have graduated from either a mechanical or academic high school. In fact, over 90 per cent of the boys selected are high school graduates.

The prospective trainee fills out and files an application giving his history. He has a talk in the employment office with one of the interviewing clerks, after which a careful check of his references is made by phone. If he appears to be desirable material, he is interviewed by an assistant superintendent who has charge of the department where he will be assigned to work.

Upon approval by the assistant superintendent, the trainee is given a physical examination and told when and where to report. Arriving at the shop the first day, he goes immediately to the safety department for instruction in safety and plant policies. He is assigned a locker and introduced to the foreman for whom he will work.

The foreman gives him an outline of the work being done in the department and in turn introduces him to the machine operator whom he will serve as a helper for the following two weeks. During his period as a helper, the trainee handles both finished and unfinished parts, has a chance to watch carefully the work being done on the particular machine, and is encouraged to ask questions about the machine.

At the end of two weeks the trainee is assigned to a machine which he operates on simple jobs with constant supervision. As time progresses, he needs less and less watching. After twelve weeks have passed, he is ready to do more difficult and complicated work.

The machine training is supplemented by courses conducted after working hours under the supervision of the vocational department of the Cincinnati Board of Education. The trainee receives instruction in blue print reading, shop mathematics, and shop theory and practice. Text books of the Ford Training School are used. Class attendance is voluntary.

A sliding scale of wages is provided by age groups. The starting rate at the age of 18 is 35 cents, at 19 it is 40 cents, and at 20 and over it is 50 cents. No matter what the starting rate, an increase of 5 cents an hour is provided every six months until the standard rate is reached.

Abstracted from **Industrial Trends**, The Industrial Association, Cincinnati, Ohio.

Problem for Engineers

Dear Sir:

In the past few years there has been a re-appraisal of engineering training, with much discussion of what studies will contribute to the young engineer's professional development. Differences of opinion have appeared concerning the kind and amount of instruction the student should receive in certain subjects, but as regards fundamental objectives there has been substantial agreement. Conspicuous among the points unanimously accepted is that every engineering student should learn how to write a good report.

This, of course, is not a new objective, but a new emphasis on a phase of training long recognized as important. It gains added force because it is an insistent recommendation coming chiefly from experienced engineers and from executives who employ engineering talent. These men appreciate the need for report-writing ability, and they know definitely when a subordinate has or lacks it.

A timely and practical contribution to this phase of an engineer's preparation is *Writing the Technical Report*, which recently appeared. The author, Professor J. Raleigh Nelson, of the University of Michigan, not only recognizes the need but does something about it. Through analysis of typical examples and through suggestions concerning preliminary study, planning, composition and criticism of reports, he points the way to their intelligent and efficient preparation. Perhaps his greatest service is in making clear the nature and function of a technical report as distinguished from other forms of writing with which it may be confused.

A report, as the author points out, has a particular task to perform, or in engineering terms, a "specific load to carry." It summarizes the results of an investigation which has been undertaken for a definite purpose; this purpose determines the design or plan of the report. Its content consists not of general information but of facts which bear directly upon the question that the investigation was meant to answer. Moreover, these facts are to be presented so they will be most readily intelligible and most directly useful to those for whom the report is intended. Conclusive evidence of the writer's clearness of thinking and his singleness of purpose is found in the brief abstract which states the object of the report and summarizes its conclusions.

The preparation of a complete well-planned report is vastly more than an academic exercise. It is a problem in thinking as well as writing. It is a means of clarifying the engineer's understanding of details in relation to the main issue. From the practical standpoint, it is an indispensable part of his training for professional success.

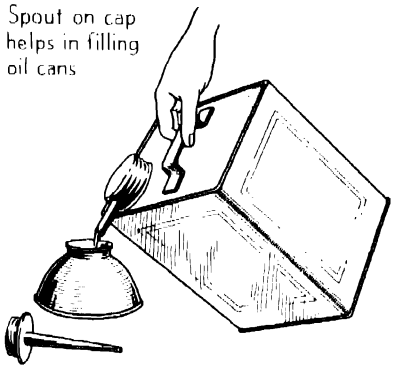
Very truly yours,

CLYDE W. PARK

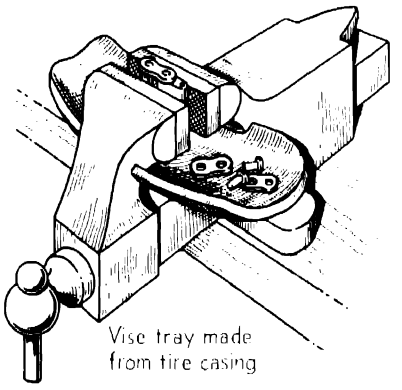
Professor of English, College of Engineering and Commerce, University of Cincinnati

Short Cuts for the Small Shop

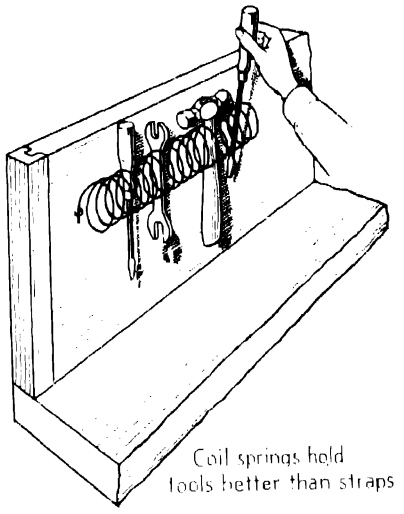
By A. H. WAYCHOFF



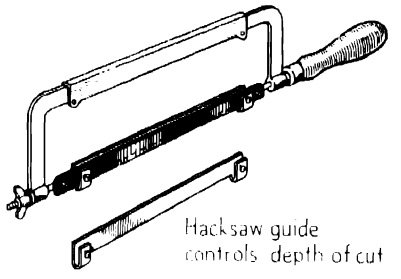
FIVE-GALLON CANS of oil can be poured into hand oilers with little trouble, using the idea shown. Screw the cap on tight and back it up about half a turn. Then drill a ⅛-in. hole through both the cap and the neck. Get a piece of ⅛-in. thin-wall tubing about four inches long and solder it onto the hole in the cap after flanging it a bit. When screwed tight the holes pass so there is no leakage, but on turning the cap the holes line up so the contents can readily be poured. This does away with all chances of dirt getting into the can and of spillage, loss or fire hazards. When the can is discarded, the cap may be saved and a hole drilled in the neck of the next can.



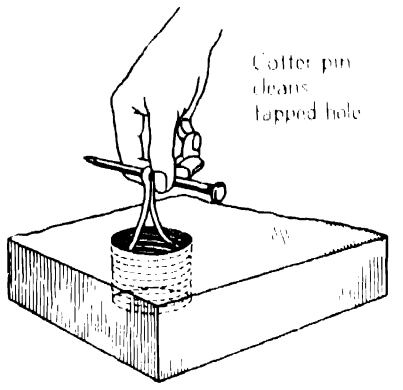
WORKING AT A VISE can be made lots more convenient with this simple little tray for holding small parts. Take a section of old auto casing and cut a couple of notches in the side so the vise can close in on it. The notches are fitted on the vise jaws and the vise may then be opened or closed without the tray interfering with it. Yet the tray is held rigid and stiff for catching any small parts. The notches should be deep enough so that the vise with the jaws completely tight will just fit in the slots, then the jaws may be opened up considerably with the slots still holding the tray in place.



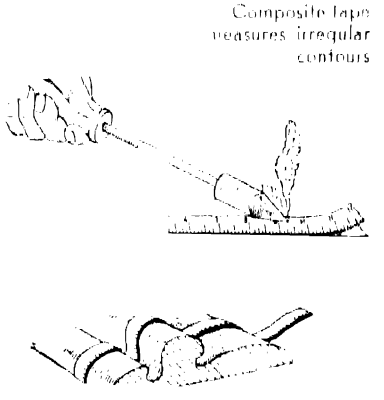
AS A RACK for holding small tools on the wall at the back of the bench, a few coil springs will be found better and handier than the usual straps. The springs should be slightly open, and attached to the wall with staples every so often. Small tools, such as wrenches, pliers, screwdrivers, etc., may then be placed in the rack by pushing them between any pair of coils. They are lots easier to take out and replace than with the usual straps, which always seem to be too tight to put a tool in and too loose to hold it after it is in.



FOR SHALLOW CUTTING with a hacksaw, this depth gage comes in mighty handy. There is nothing to do but cut out a shape about half an inch wide with two L-shaped ends being left about an inch and a half long. The over-all length should be a little less than the distance between the hacksaw blade holes. Then each end is given a return bend, and several ¼-in. holes drilled and tapped in one side of the bent part. Each end is fitted with a small thumbscrew. The gage can quickly be adjusted so the saw cuts anything from a tiny scratch up to about half an inch deep. That way slotting screw heads, duplicate cuts, grooving and fine rack cutting can be done easily and uniformly.



WHEN MACHINERY'S being overhauled, all threaded holes should be cleaned out properly. Few mechanics have the proper tools to do this, but a good job can always be done by using an ordinary cotter pin sprung out as shown. Just screwing it down the hole with a nail run through the eye cleans all grease and gum from the threads. That way the machine's easier to put back together, and a cleaner job is done.



A SWELL TAPE for measuring irregular objects can be made from an ordinary steel tape and a thin strip of lead. One machinist cut off about two feet of the tape, and cut a piece from sheet lead about a sixteenth of an inch thick and the same width and length as the tape. He cleaned both the back of the tape and one side of the lead with soldering acid and tinned them. Then he sweated the two together. This made a one-piece tape which could easily be bent into almost any shape. He uses it to measure all sorts of irregular shapes, and to transfer contours. Says it's better and simpler than any other gadget he's seen to do the same thing. When he's through, he just pulls it between his thumb and forefinger to straighten it out.

Comparison instruments

BY C. C. STREET, CHIEF ENGINEER, FEDERAL PRODUCTS CORPORATION

Optical and electrical units for comparison magnifying are generally more satisfactory in making precise measurements than are most mechanical units

COMPARISON INSTRUMENTS are distinct from direct-measuring instruments in that they contain within themselves no absolute standard. They do, of course, have a scale of a reasonable degree of precision for a short range to either side of some nominal zero point. The magnitude of this range is dictated by the purpose for which the instrument is made. The simplest of all such comparison or indicating instruments is the familiar "wiggler" which has been used by shop mechanics for many years to center a punch mark on a piece mounted on the faceplate of a lathe. This device has been improved from time to time and finally has taken the form of a simplified indicator operated by a series of multiplying levers. Some instruments of this type are offered commercially, one being the "Ideal" indicator which consists of two levers and a dial graduated to 0.001 in. over a range of approximately 0.010 in.

The next step in mechanical indicating devices is the gear driven dial indicator which is in common use today. The origin of this instrument is uncertain, but at some time during the early part of this century, two mechanics of the Waltham Watch Company built for their own use some dial indicators from various watch parts. These later were manufactured by the Waltham Watch Company for application on their measuring problems. At a later date these two men went into business for themselves and today are manufacturing dial indicators on a commercial basis.

The dial indicator has reached a high degree of perfection in its present form, and engineering principles indicate that there will not be a great deal of improvement in their various characteristics, because of inherent errors that always must exist, even to an extremely minute extent, in any fabricated metal part. There always will be periodic and cyclic errors in the accuracy of the readings indicated. In a gear driven dial indicator the geometry of gearing shows that two gears can never transfer velocity from one staff to another without periodic change in the torque delivered. This is due to the friction absorbed by the faces of the gear teeth. This friction various from some minimum to maximum value with each tooth cycle.

The general principle of a comparison indicator is to magnify faithfully a minute amount of motion until it can be read with an appreciable degree of ease. Since the greater the magnification used the greater will be the friction, in most instances, it is advisable never to use an instrument of higher magnification than required for the particular problem at hand. A reasonably good criterion of the magnification needed will be such that the instrument will indicate with a motion of approximately 0.050 in. the least unit that it is desired to read. An example of this might be the use of an instrument having the magnification of 50-to-1 when the precision desired is 0.001 in. It is often thought that the greater the magnification is the more accurate the measurement will be. This reasoning is as fallacious as that of a carpenter using a micrometer caliper graduated to 0.0001 in. for

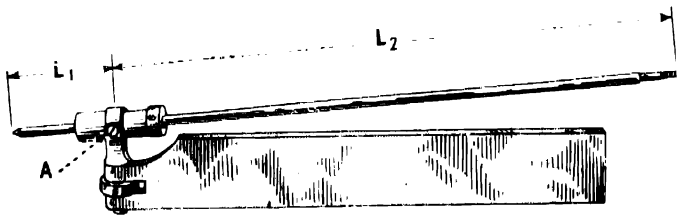


Fig. 1—The simplest form of indicator is the familiar "wiggler" used for many years to aid in centering parts on the faceplate of a lathe for precision boring

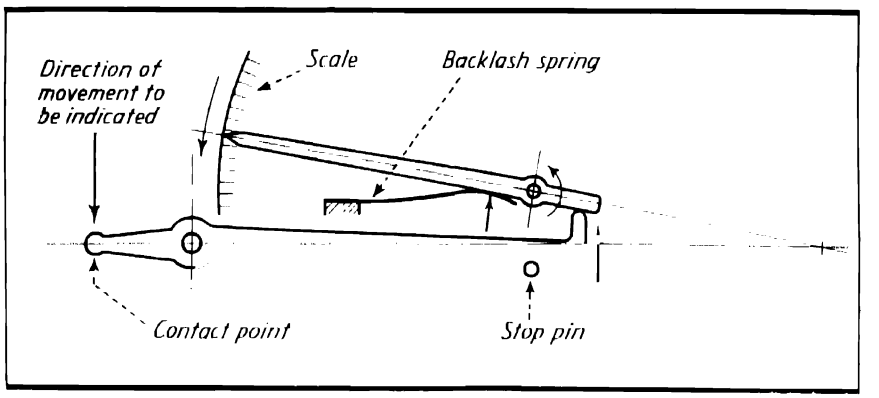


Fig. 2—By using a series of levers the over-all magnification of the "wiggler" is broken up in the well-known shop indicator. Reliable readings are possible at up to 50-to-1 magnification

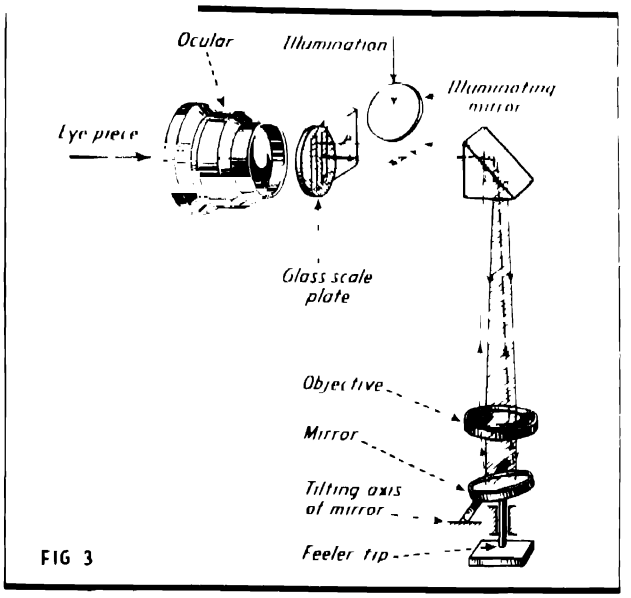


Fig 3— This sketch shows principal parts and optical system of the high magnification Zeiss optimeter. Both a reflected scale and a reference line are viewed through the eyepiece

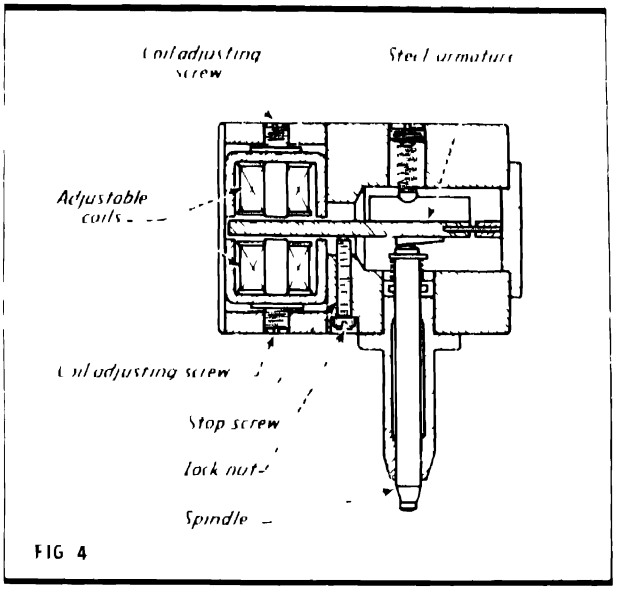


Fig 4 Gage head of Pratt & Whitney's electrolimit gage is arranged to alter the impedance of two magnetic coils when the spindle moves the steel armature up or down

measuring the thickness of his planed boards.

Many instruments of high magnification have been developed for special purposes; some of these are the Zeiss optimeter, the Pratt & Whitney electrolimit gage and the Sheffield reed comparator. These, for the most part, originally were developed for the comparison of master gages and size blocks. Later, due to the increased precision of production manufacture, these instruments have been used for routine inspection, particularly in the automotive and aircraft engine field.

The simplest form of indicator is shown in Fig. 1. It consists of a multiplying lever pivoted at point A. The amount of magnification is equal to the ratio of L_1 to L. The possible magnification to be obtained from such a device is definitely limited by the weight of the long pointer necessary to obtain a large value of L. The magnification can be increased by reducing L_1 to an extremely small value, but then the load placed upon the pivot becomes excessive and friction produces erroneous readings. The greatest possible satisfactory magnification that can be obtained is approximately 20 to 1, and if we use this previously mentioned 0.050 in. as the smallest readable motion, we would then have as the least unit to which this instrument can read 0.0025 in. This principle of magnifying levers can be improved upon by using extremely light members and breaking the overall lever magnification into two separate units. Such a device is shown schematically in Fig. 2. It will

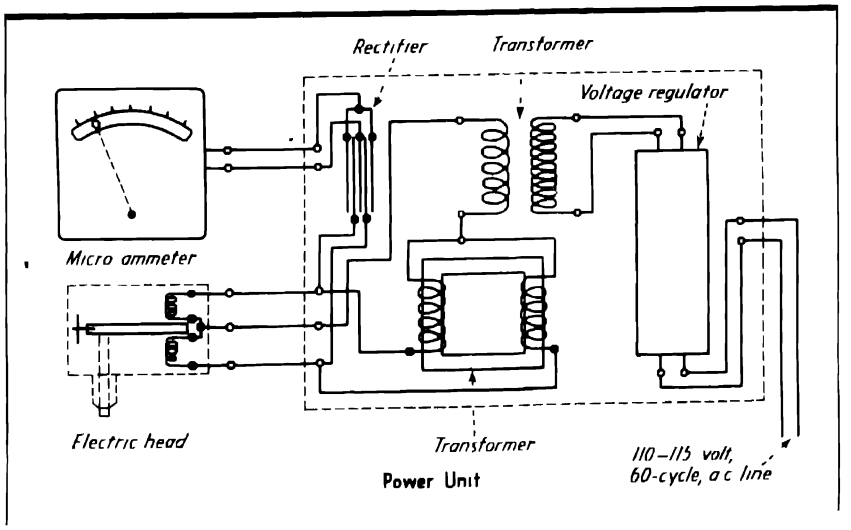
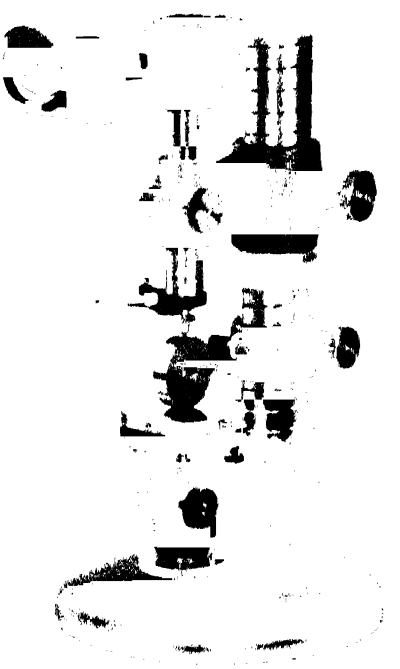


Fig 5—Electrical circuit of the electrolimit gage is relatively simple. This instrument has given magnifications of 10,000 to 1 and higher on some applications



Head of the Zeiss optimeter can be mounted vertically as shown or horizontally for precision measurements. The least division on the scale of this instrument indicates a 0.00005 in. movement of the contact point

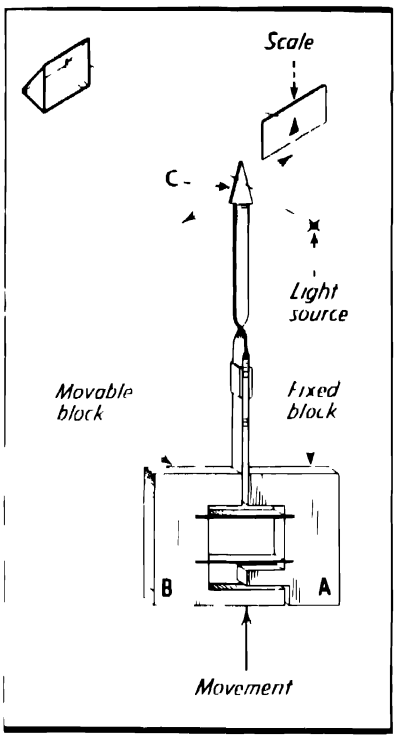


Fig 6 Sheffield's feed comparator has two spring connected blocks which move rectilinearly with respect to each other

be noted that this permits a lighter construction and is capable of higher magnification with less pivot friction An analysis of the forces exerted at the pivots will show the manner in which the improvement is obtained Such an instrument as this can be used up to magnifications of 50 to 1 giving very reliable readings

Dial indicators follow very generally the same pattern with most manufacturers differing only in minor detail of design and method of assembly They generally can be described as consisting of a rod running in two accurately reamed bushings, and having attached to it a pin fitted into a slotted guide so that this rod is free to move longitudinally but not to rotate axially In the side of this rod are cut a series of rack teeth which mesh with a pinion, usually having from 16 to 40 teeth depending upon the magnification of the particular instrument Mounted on the same staff with this pinion is a gear having a larger number of teeth usually between 75 and 200 teeth In the lower magnification instruments this gear meshes with a small pinion that is placed in the center of a circular dial, and to which the hand is fixed Motion of the rack spindle causes this system of gears to revolve about their axis and in this manner the hand passes over the graduated dial to indicate the amount the rod or rack-spindle has been moved

There usually is, in addition, some place in the system, another gear meshed with the center pinion and having attached to it a hair spring for the purpose of absorbing back lash in the gear train In instruments of high magnification, where one revolution of the hand is equal to 0 050 in motion of the rack spindle there usually is interposed between the gear assembly that meshes with the rack spindle and the center pinion another set of gears to obtain this higher magnification A few instruments that are compounded to an even greater extent have been tried experimentally, but friction and inertia of the moving parts have made such devices highly impractical

The highest gear ratios that have so far shown themselves to possess satisfactory characteristics are those giving one revolution of the indicating hand to a motion of the rack spindle of 0 010 in By using a dial $3\frac{1}{4}$ in in diameter this gives a magnification of approximately 1 000 to 1

The Zeiss optimeter is perhaps the most notable of the high magnification comparing instruments It is optical in principle and the major parts are shown schematically in Fig 3 A small scale, photographically engraved on glass, is viewed through the eye piece as a reflected image from a movable mirror The mirror is mounted on knife edges so that a slight motion of the contact point causes it to tilt There is in the focal plane of the eye piece a fine reference line and the lenses are so arranged that the scale is projected as an image at this focal plane In this manner both the scale and the reference line can be viewed simultaneously through the eye lens

The effect produced is such that as the mirror is tilted the scale appears to move and the amount of motion of the contact point is determined by the division of the scale which appears opposite the reference line The least division on the scale of this instrument corresponds to a movement of the contact point of 0 00005 in The mirror mechanism is so arranged that the contact plunger operates under a pressure of approximately 8 oz This instrument is an indicator in the pure sense of the word and its most common application has been on a comparison stand as shown

One notable attempt to obtain high magnification with a simple mechan



An advantage of the electrolimit gage made by Pratt & Whitney is the fact that the indicating meter can be placed in a position most convenient for the operator The head also can be connected to a recorder



Magnifications as high as 10,000 to 1 are made satisfactorily with the reed comparator offered by Sheffield

ism is the Prestwitch fluid gauge manufactured in London by J A Prestwitch & Company This consists of a flexible bellows chamber of rather large capacity, to which is attached a long glass tube A contact point is integral with the lower half of the flexible chamber, so that a slight motion of the contact point displaces an appreciable amount of the fluid with which this chamber is filled Since the only place the liquid can go is up the glass tube, it gives an indication of the motion of the contact point The ratio of magnification is equal to the ratio of the area of the bellows chamber and the bore of the glass tube Instruments possessing various magnifications between 500 to 1 and 1,200 to 1 have been made Due to the fact that in many respects the instrument is similar to a thermometer, it is quite sensitive to temperature variations Because of this effect, it has found but slight use in this country during the past ten to fifteen years

Many electrical devices have been experimented with, but the only one that has shown practical commercial value to date is the Pratt & Whitney electrolimit gage The principle of this unit is to alter the impedance of two magnetic coils by having a steel armature move between the ends of their cores This instrument has given satisfactory magnifications of 10,000 to 1 and higher Here, again, the electrical head of this instrument can be used as an indicator in a manner similar in most instances to the application of dial indicators, with the added advantage that the indicating meter can be placed in the most convenient position to be observed by the operator or at a remote point up to distances of several hundred feet Such a device can also be used to operate a recorder, so that a continuous and permanent record of the measurements obtained will be made automatically The gaging head is shown in Fig 4 and the electrical circuit in Fig 5

The Sheffield reed comparator operates on the novel principle of having two metal springs attached together at their ends is shown in Fig 6 One spring is rigidly attached to block *A* with the other spring attached to block *B* They are so mounted as to move rectolinearly with respect to each other A motion of block *B* causes the two reed springs to move in an arc as shown by the arrow An image of the pointer attached to the end of these springs is projected by lens *C* against a scale In this manner magnification is obtained mechanically by the arc motion of the reed springs, and optically by the magnification of the objective lens C Magnifications as high as 10,000 to 1 have been developed with this principle

It can be seen from the foregoing that comparison instruments consist primarily of ingenious methods of magnifying minute motions The attempt is always to obtain this motion with as frictionless a mechanism as possible The optical and electrical methods approach this requirement to a far greater extent than the straightforward mechanical devices In the final analysis, the usefulness of any indicating instrument is the precision with which it will repeat its readings under identical external conditions As an example assume an indicating device placed above an accurately lapped table and a 1 in size block placed between the table and the contact point If, regardless of the speed or direction at which the block is passed under the contact point, it always indicates the same value, it would then be an ideal comparator This condition is seldom realized, but in many of the higher quality instruments, the deviations caused by friction and erratic movements of the mechanism have been reduced to such an extent that such errors are hardly detectable

The third article in this series by Mr Street will appear in an early issue

Connecting Rod Contours

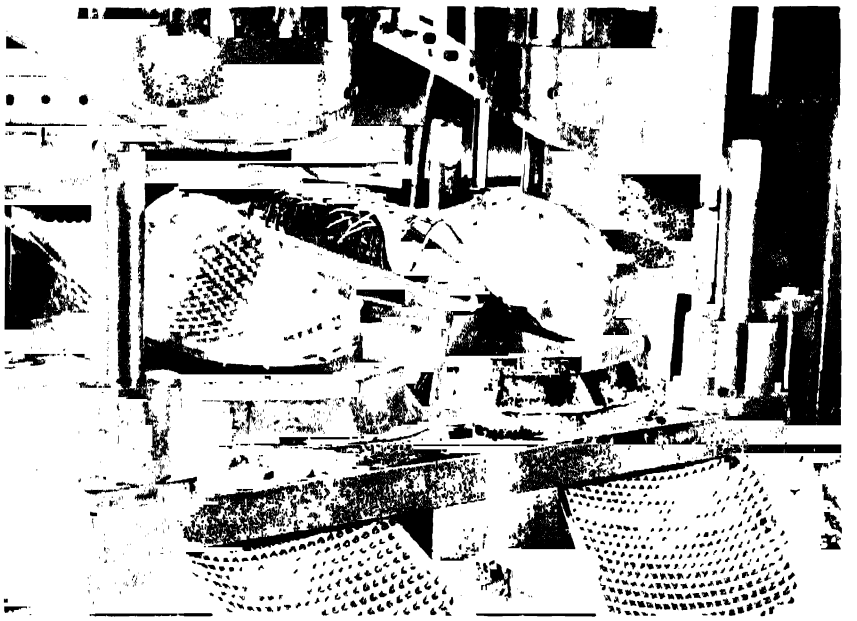
DEVELOPMENT of a duplicating attachment that will automatically contour mill the outside of the bosses of connecting rods should prove of interest to aircraft engine makers in this country and abroad The tracer is set up to a master the operator presses a button and then proceeds to load or unload as many as three other machines while the first one is automatically going through its cycle The tracer follows around the entire contour and returns to the original starting point

Successful operation of this attachment which costs about 50 per cent as much as a first class milling machine, depends upon a two way clutch that controls the table so as to proportion the depth feed to the cross feed in the correct manner Smooth finish results, and the maker of the attachment believes that no further operations such as grinding would be required The attachment can be used for cutting cams or any contour on common parts

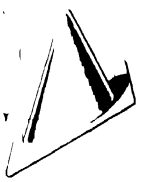
Knockout flash removal

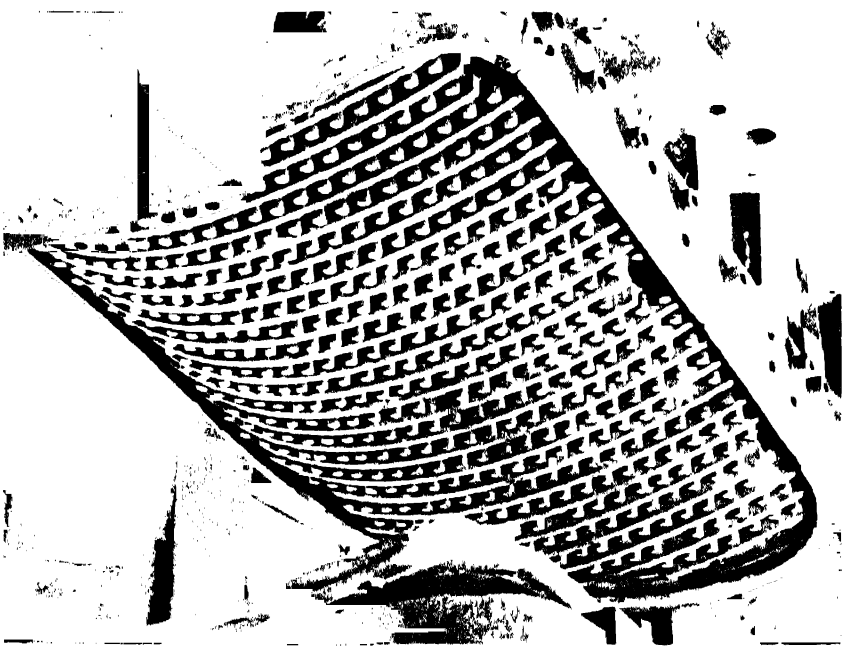
BY HERBERT CHASE

Instead of shearing flash from each of 400 holes with precise punches, Doehler knocks it out with pins. It breaks properly



Dies which trim flash from Studebaker radiator grilles shear it from the outside contour in the usual way but use round pins to knock it out of the square holes. Flash sketch right in each hole is thinnest at the edge and has a cone at the center which contacts a knockout pin. Each pin below is slightly cupped and floats somewhat to permit centering on its individual cone





A BIG PROBLEM in producing die cast automobile radiator grilles is removing flash at parting lines. As a rule this is done with a trim die in a punch press. Such dies shear flash from the contour, and may carry punches which shear it simultaneously from spaces between grille bars.

But there are over 400 such square holes in a typical grille. Trim dies would be very expensive if punches to fit each hole were required, and a great deal of labor would be necessary to keep the punches sharp and in correct alignment. An effective way to avoid these difficulties has been developed by Doehler Die Casting Company for trimming flash from Studebaker grilles. Flash in each hole has cast in its center a cone, the axis of which is parallel to the press stroke. From the cone outward the thickness of the flash decreases until at the joint with the four sides of the hole it is only a few thousandths of an inch. Punches are all circular. They are allowed to float within limits, and their ends are cupped so that as the die is closed they center on the cones. Further motion results in shearing the flash but the punches do not touch the sides of the hole at all. The shear is remarkably clean, and relatively little filing is required. The punches, of course, do not require sharpening.

The die is made to cut flash from the casting contour in the usual way with a true shearing action. A right and a left hand grill are required for each car, so the trim die is a duplex type which trims both at one stroke. As the grille has a warped surface, the lines where flash is sheared lie in similarly warped planes. Hence although the axes of all cones are parallel, their bases lie at different angles in the warped parting surface. This however appears to make no difference in shearing, which is as clean in one hole as in another. Approximately 70 pairs of grilles an hour are handled through the press.

A compressed air manifold between the dies carries pipes bent to blow flash away after the die opens. Two operators are used at the press, each loading and unloading one section of the die. Electrical interlocks are used for safety.

The Working of ALUMINUM ALLOYS

LIGHT weight, ease of fabrication, high resistance to corrosion, good thermal and electrical conductivity, and high metallic luster are characteristics which have helped make aluminum the fifth most commonly used structural metal. Aluminum weighs only about one-third as much as most of the common metals. Only beryllium and magnesium are lighter. The usual metalworking processes can be used for rolling, spinning, drawing, extruding and forging aluminum and its alloys. Complicated forms are produced by the sand-, permanent-mold and die-casting processes.

Commercially pure aluminum, in the annealed condition, is very ductile when cold and can be drawn to greater depths than can copper, brass or steel. It is relatively difficult to machine. Many of its alloys, however, are readily machinable. Commercially pure aluminum has poor casting characteristics, hence one of the alloys ordinarily is selected for making a cast part. Additions of small amounts of other metals, singly or in various combinations, substantially increase the physical properties of aluminum.

Broad generalizations as to the corrosion resistance of aluminum and its alloys are difficult, since corrosive action is determined by many factors. In general, alkalis will attack aluminum more rapidly than will acids. Often dilute acid solutions have a gerater solvent action than do concentrated acid solutions. Concentrated hydrochloric acid attacks aluminum vigorously, yet shipping containers made of this metal are used for concentrated nitric acid. However, dilute solutions of nitric acid often are as corrosive as hydrochloric or sulphuric acids when in contact with aluminum. Inhibitors, such as sodium silicate or potassium dichromate, sometimes are added to aluminum to reduce the solvent action of strong alkalis.

In contact with moist air, aluminum quickly acquires a thin, impervious film of aluminum oxide which serves as a protective barrier against further attack. A thicker oxide film can be formed electrolytically where greater resistance to certain types of corrosion is required. This oxide film is transparent and may be treated with dyes or inorganic pigments to color the surface.

Where aluminum or aluminum alloys are assembled in contact with other metals, and water is present, there is danger of galvanic attack of the aluminum. To prevent this electrolytic action, it is best to insulate the dissimilar metals with bituminous paint, fiber strips, or asphalt-saturated felt.

HISTORY OF ALUMINUM

Aluminum is the most abundant of all industrial metals. Estimates indicate that it makes up about 8 per cent of the earth's crust. It is the third most abundant element (following oxygen and silicon), but never is found in nature in its metallic form. It is an essential constituent of almost all important rocks, except the sandstones and limestones, and usually occurs as oxidized compounds with other elements.

It was not separated in metallic form until 1825, when Hans Christian Oersted, a Danish physicist and chemist, heated aluminum chloride with potassium amalgam. Frederick Wöhler, a German, obtained the metal in 1827 when he substituted metallic potassium for the amalgam used by Oersted. Henri Sainte-Clair Deville substituted metallic sodium for metallic potassium and started commercial production of the metal in a plant near Paris in 1856. His process was purely chemical, as were the processes used by those who preceded him.

It was not until 1886 that an economical means of producing metallic aluminum became available. In that year Charles Martin Hall, in the United States, and Paul Louis Toussaint Heroult, in France, independently discovered substantially similar electrolytic methods of extracting metallic aluminum from its oxides. The process used today for the production of aluminum is essentially the same as that discovered by Hall and Heroult.

Wilm's discovery, in Germany, that certain aluminum alloys were susceptible to improvement in mechanical properties by heat-treatment marked the opening of new fields for aluminum alloys. There now is available a series of strong, light aluminum alloys which, in wrought heat-treated form, have properties equivalent to those of mild steel.

Production of metallic aluminum on a commercial scale today is carried out in two major steps: (1) the preparation of *alumina* from bauxite, and (2) the electrolytic reduc-

This section was made possible through the cooperation of the following companies:

Aluminum Company of America
E. C. Atkins and Company
Blanchard Machine Company
Brown & Sharpe Mfg. Company
Bryant Chucking Grinder Co.
Carboloy Company
Cincinnati Bickford Tool Co.
Cincinnati Milling Machine Co.
Cincinnati Shaper Company
Cowles Detergent Company
Henry Disston and Sons
Eastern Machine Screw Co.
Geometric Tool Company
Greenfield Tap & Die Corp.
Hanson-Van Winkle-Munning Co.
Illinois Tool Works
Landis Machine Company
Landis Tool Company
Lincoln Electric Company
McKenna Metals Company
Michigan Tool Company
Milwaukee Metal Spinning Co.
Morse Twist Drill & Machine Co.
National Twist Drill & Tool Co.
Nicholson File Company
Norton Company
D. A. Stuart Oil Company
The Texas Company
Tide Water Associated Oil Co.
Vascoloy-Ramet Corporation

tion of aluminum from alumina in a molten bath of cryolite. A number of processes have been devised for obtaining alumina of high purity from the bauxite ore. The one now used almost universally is the "Bayer" process, in which the aluminum hydrate of the ore is dissolved out by means of a hot solution of sodium hydroxide, filtered to remove impurities, allowed to cool and treated to cause precipitation of aluminum hydroxide. This hydroxide then is separated by a second filtering operation and calcined to form pure aluminum oxide.

Successful operation of the Hall-Heroult electrolytic process is based on the solvent action of cryolite on alumina, and the fact that alumina, when dissolved in cryolite, can be decomposed by an electric current without effecting a change in the solvent cryolite. In the operation of the reduction cell, aluminum is separated continuously and is withdrawn from time to time as it collects in the bottom of the cell.

ALUMINUM-BASE ALLOYS

Metals most commonly added to aluminum in the production of commercial aluminum alloys are copper, silicon, manganese, magnesium, chromium, iron, zinc and nickel. These elements may be added singly, or some combination of them may be used to produce the desired characteristics in the resulting alloy. Where the alloy is to be used in wrought form, the total percentage of alloying elements seldom is more than 6 to 7 per cent. Appreciably higher percentages frequently are used in casting alloys.

Aluminum-copper alloys are widely employed because they are more easily cast than pure aluminum, are harder and stronger, and are more easily machined. Alloys containing up to 13 per cent silicon have excellent casting qualities, including fluidity and freedom from hot-shortness. Other advantages are high resistance to corrosion, low weight, low thermal expansivity, and high conductivity for heat and electricity. Elastic limits of aluminum-silicon alloys are, in general, lower than those of aluminum-copper alloys of about the same tensile strength. The aluminum-silicon alloys can be hardened by solution heat-treatment. Alloys containing substantial amounts of silicon are not so easy to machine as other aluminum alloys. There is a tendency for the metal to drag and pile up on the cutting surface of the tool, leaving rough surfaces on the work. The abrasive effect of the hard silicon particles leads to excessive tool wear. This has, in many cases, been overcome by using tungsten-carbide tools.

The addition of copper to aluminum-silicon alloys improves their machinability by decreasing their plasticity, but increases the abrasive effect of the silicon particles, since the increased hardness of the alloy holds these particles more firmly against the cutting tool. Aluminum-copper-silicon alloys can be greatly improved by heat-treatment. They are easily cast. Corrosion resistance of these ternary alloys is lower than that of either the binary aluminum-copper or aluminum-silicon alloys.

The wrought aluminum-copper-magnesium-manganese alloy (Alcoa 17S) commonly called *duralumin* is the oldest of the so-called "strong" aluminum alloys. It still is used for a wide variety of products. Where good forming characteristics are essential, and lower physical properties acceptable, a modified composition (Alcoa A17S) is available. This alloy frequently is used for rivets, because it can be driven in the fully heat-treated and aged condition. In the soft temper these alloys can be subjected to severe forming operations.

SAND-CASTING ALLOYS

Higher mechanical properties and superior casting qualities make aluminum-base alloys more suitable for castings than the commercially pure metal. Aluminum casting alloys are of two types: in the first group are those alloys in which improved properties result from alloying only, while in the second group heat-treatment processes are used to effect further improvement of the properties obtained by alloying.

Several alloys are available in each of these groups, the choice among them depending upon service requirements and, in some cases, on the ability to cast the desired part. Some are adapted for use at elevated temperatures, some are particularly resistant to corrosion, and some are more easily cast into complicated shapes. In the design of patterns for aluminum-alloy sand castings, a shrinkage of 0.156 in. per ft. usually is allowed.

Most aluminum-alloy sand castings are made of general-purpose alloys, many of which contain copper as the hardening agent. Alloys containing silicon as the hardener have excellent casting qualities and can be used in the production of large thin-sectioned castings of intricate design, or of castings which have adjoining heavy and light sections.

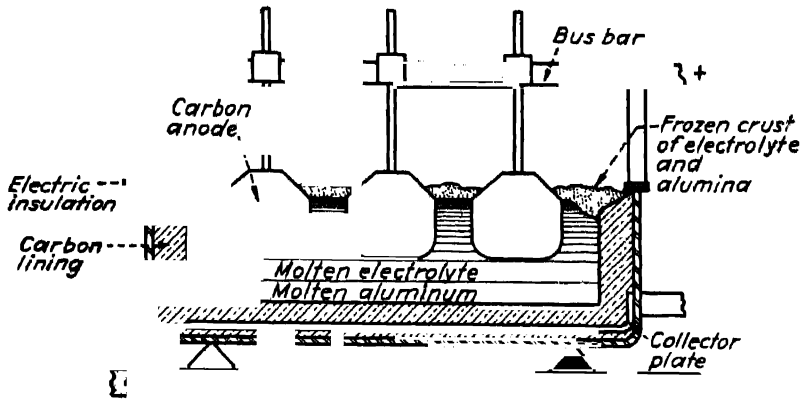
The use of heat-treated castings has increased rapidly since their introduction some time ago. The alloy in greatest use, Alcoa 195, contains about 4 per cent copper. Castings are produced in three heat-treated tempers, that produced by solution heat-treatment followed by room temperature aging (Alcoa 195-T4) being the one most commonly used.

Castings in Alcoa 220-T4 alloy have the highest combination of tensile and yield strengths, elongation and resistance to impact of any of the aluminum alloys. This alloy also has excellent machining qualities. The high magnesium content makes necessary the use of special foundry practices.

Some of the alloys used for sand castings also can be used in the production of permanent-mold castings;

PHYSICAL CONSTANTS OF PURE ALUMINUM

Atomic weight	26.97
Specific gravity at 20 C. (68 F.), g. per cu.cm	2.70
Weight at 20 C. (68 F.), lb. per cu.in	0.098
Weight at 20 C. (68 F.), lb. per cu.ft	168.56
Melting point, degrees Fahrenheit	1,220
Boiling point, degrees Fahrenheit	3,272
Latent heat of fusion, B.t.u. per lb	169
Heat of vaporization, B.t.u. per lb	3,510
Mean specific heat (32 to 212 F.), cal. per g	0.226
Thermal conductivity (32 to 212 F.), B.t.u. per sq. ft. per in. thickness per deg. Fahrenheit per hour	1,509
Electrical resistivity at 20 C. (68 F.), michrohms per cu. cm	2.65
Mean coefficient of thermal expansion per deg. Fahrenheit (68 to 572 F.)	0.0000142
Tensile strength, lb. per sq. in	9,000
Yield strength (set = 0.2 per cent), lb. per sq. in	3,000
Elongation in 2 in., per cent	60
Modulus of elasticity, lb. per sq. in	10,300,000
Modulus of rigidity (torsion), lb. per sq. in	3,870,000
Poisson's ratio	0.33
Reflectivity for white light, per cent	90
Compressibility (change in volume per megbar pressure)	0.0000014



Alumina is changed into aluminum, a silvery metal, in the Hall electrolytic cell. These steel cells are lined with carbon, which serves as the cathode. The carbon anodes reach into the cell from above. In the process, cryolite kept molten by the electric current, and alumina is dissolved in it. The current which passes through the molten bath electrolytically changes the alumina into oxygen, which reacts with the anodes, and metallic aluminum, which is deposited on the bottom

other alloys have been developed primarily for this purpose. Because of the finer grain structure resulting from the rapid solidification of the metal, permanent-mold castings have greater susceptibility to heat-treatment than do sand castings. In the case of aluminum-silicon alloys, the structure and mechanical properties are similar to those obtained by the modification process in sand castings.

The molds used in the permanent-mold process generally are made from special alloy cast iron. They may consist of two or more pieces, and either metal or sand cores be used. When metal cores are employed, it is necessary to withdraw them just as soon as the casting has set sufficiently, and before solidification shrinkage is complete. Otherwise, cracks are likely to occur in the casting because of the hot-shortness of practically all aluminum-base casting alloys.

DIE-CASTING ALLOYS

Choice of the alloy to be used for die castings is determined in some measure by the nature of the casting. Different alloys have different casting characteristics, and the ability to produce the most satisfactory casting of the desired design may be the deciding factor in the choice, rather than the mechanical properties as determined from a separately cast test specimen. Die castings ordinarily can be produced with tolerances of a few thousandths of an inch, while permanent-mold castings require tolerances of at least 1/64 in. and sand castings need much more.

While the initial cost of aluminum-alloy die castings is somewhat above that of die castings made from other white metals, they are light in weight, have superior resistance to corrosion, have a high degree of permanency of shape and dimension, and have good electrical and thermal conductivities. Most of the aluminum-alloy die castings are made from the aluminum-copper, aluminum-silicon or aluminum-copper-silicon groups of alloys.

WROUGHT ALLOYS

There are two types of wrought aluminum-base alloys, just as there are two types of casting alloys. In one class of the wrought alloys, the harder tempers with increased tensile properties are produced only by strain hardening, i.e., by cold working. In the second class of alloys, the higher strengths are produced by heat-treatment processes. Several alloys of each of these types, covering a wide range of physical properties and forming qualities, are commercially available in the forms into which metals are fabricated.

In the system of nomenclature adopted by the Aluminum Company of America for aluminum alloys, the wrought alloy numbers are followed by the letter *S*. The temper of the alloy is indicated by additional letters following the letter *S*, but separated from it with a hyphen. The letter *O* is used to indicate the annealed, or dead-soft, condition; in the strain-hardened alloys the letter *H*, indicates the full-hard condition. Intermediate tempers are shown as: quarter hard, $\frac{1}{4}H$; half-hard, $\frac{1}{2}H$; and three-quarter hard, $\frac{3}{4}H$.

The letter *O* also indicates the annealed condition in the heat-treatable alloys. The letter *T* following the alloy number indicates that the alloy is in its fully heat-treated and age-hardened condition. The symbol *W*, used only with the alloys which require artificial aging or precipitation heat-treatment, indicates that the alloy has been subjected to the solution heat-treatment, but has not been artificially aged. The temper which results from strain hardening an alloy after it has been heat-treated is designated by the symbol *RT*. Where the alloy is supplied with mechanical properties produced by a modification of the usual heat-treatment and strain-hardening processes, the temper is denoted by the letter *T* and a number like 11S-T3.

Hard tempers of the "common" (non-heat-treatable) aluminum-base alloys are produced by cold working. Of these alloys, commercially pure aluminum (Alcoa 2S) is the most easily worked. The annealed temper of each of the alloys is the best for the most severe forming operations. For many purposes the strengths of the non-heat-treatable alloys are entirely adequate, and their use offers the advantage of lower cost and greater ease of fabrication than do the heat-treatable alloys.

Normal use of the "strong" heat-treatable alloys is in the heat-treated condition—in the annealed temper they have mechanical properties comparable with those of certain of the "common" alloys. Of the heat-treatable alloys, Alcoa 17S or *duralumin* is the most extensively used. Its properties are obtained by heating at 930 to 950 F. and quenching in cold water, after which it is allowed to age for four days at room temperature. Hardening of heat-treatable alloys produced by cold working is accompanied by a loss of ductility—the elongation of these alloys when hardened by heat-treatment may be somewhat greater than that of the annealed material, although the plasticity and workability generally are less.

In all of the heat-treatable alloys, plasticity and workability are better directly after the solution heat-treatment than after age hardening, whether this be spontaneous or obtained by heating after quenching. The annealed temper of these alloys is best for severe cold-working operations, such as upsetting, bending, drawing and forming.

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HOT AND COLD FORMING OF ALUMINUM

With its combination of strength, ductility and malleability, aluminum is adapted to fabrication by nearly all of the processes known to the metalworker. Many of the aluminum-base alloys also can be worked satisfactorily, although the conditions of working may be somewhat different than for pure aluminum. Commercially pure aluminum can be worked over a wide range of temperature. Cold working results in strain hardening the metal, but by proper annealing the metal can be softened again.

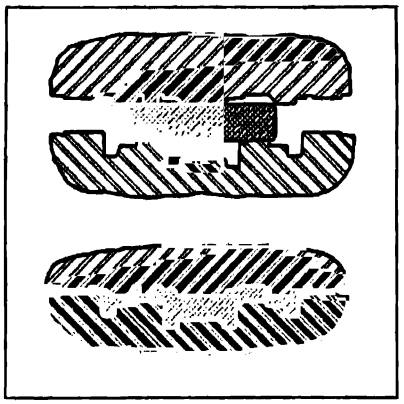
HOT FORMING

Hot forming has only limited application among the alloys whose tempers are produced by definite amounts of strain hardening by cold work. In the soft tempers all of these alloys have good forming qualities; if heated in the harder tempers, care must be exercised to avoid heating to the annealing temperature. At temperatures above 600 F. they are quite plastic, but on cooling to room temperature they are practically in the annealed state. Much improvement in bending qualities is obtained when working at 300 to 400 F., in which temperature range there is little loss in strength and hardness on cooling.

Heating may affect not only the mechanical properties of the heat-treatable alloys, but in some of the alloys may impair their normal resistance to corrosion. Heating to 400 F. materially improves forming qualities of these alloys; if held at this temperature for not more than one-half hour the loss in tensile values is practically negligible. At temperatures in the heat-treating range, the heat-treatable alloys are quite plastic and can be severely deformed. They may be reheat-treated after forming, or the heat may be removed by the forming dies with sufficient rapidity to constitute a quench, so that properties of the heat-treated tempers are developed after suitable aging. For some operations, somewhat lower forming temperatures give better results, in which case the part may be reheated to heat-treatment temperature and quenched in the die. Where this method is used, the dies must be of sufficient mass to provide rapid cooling of the alloy.

Forging of aluminum alloys differs from the forging of other metals principally in the temperature used and the limited range of working temperature for many of the alloys. Almost all aluminum alloys are hot-short, and many of them are cold-short. Frequent annealing between forging reductions is required for certain alloys when they are forged cold. In the design of the die, a draft of 10 deg. should be used for aluminum alloys. A shrinkage of $\frac{1}{8}$ in. per ft. ordinarily is allowed in the die cavity.

Aluminum alloy pressings may be made with hot or cold blanks, de-



In hot or cold pressing of aluminum, the slug is placed in the cavity and in one blow the metal is caused to flow and assume the form desired. In most pressings, the metal is confined to a greater degree than is the case in the impact-extrusion process

pending on the size of the part, its shape and the necessary displacement of the metal. Cold pressings ordinarily cannot be made if there must be considerable horizontal flow of the metal. Mechanical properties required in the finished part also have a determining effect on whether a hot or cold blank is to be used. In this method of forging, taper or draft can be reduced, thus minimizing machining after pressing. A smoother surface is obtained, since the displacement of the metal is accomplished in one blow. Hydraulic or mechanical presses may be used.

COLD FORMING

When worked at temperatures below those required for annealing, aluminum and its alloys strain harden. The resultant increase in strength and reduction in ductility is, for most of the alloys, directly proportional to the amount of cold work when this working is within the range normally used for commercial manufacturing operations. Relative ease of forming the various grades and tempers, as well as the amount of cold forming that can be done, varies with the nature of the operation and the equipment employed.

The character of the cold work done on aluminum has little effect on the final mechanical properties obtained. A given amount of reduction by rolling, drawing or forging will give the metal the same final mechanical properties, provided the rate of reduction is the same. Rate of working, or rate of reduction, per pass, draw or blow may cause some variation in mechanical properties.

Shearing of aluminum and aluminum alloys readily can be accomplished in power-driven squaring shears or rotary shears where thickness is less than $\frac{1}{2}$ in. Shearing tools should be sharp and a proper clearance must be allowed if the sheared edges are to be smooth and free from burrs. Usually a clearance of one-eighth of the thickness of the sheet or plate is sufficient in die-punching operations and can be employed in squaring shears when provided with a mechanical hold-down. A low rake or shearing angle on the upper shear knife reduces twist in thin stock. Walls of the opening in dies for blanking are tapered away from the cutting edge 3 to 5 deg. to permit punched pieces to fall freely. Material thicker than $\frac{1}{2}$ in. should be sawed.

In drawing operations, the amount of reduction in diameter of the blank or shell during each draw has an important relation to the possible depth of draw and the smoothness of the finished product. A deeper shell can be drawn without an intermediate anneal when the diameter is reduced by series of easy draws than when the shell is completed in one draw. Generally, the diameter of the blank should not be reduced more than 40 to 50 per cent in the first draw, and partially drawn shells should not be reduced in diameter by more than 25 per cent per draw.

Close-grained cast iron, semisteel, or hardened tool steel may be used in making tools for press drawing or stamping operations. Radius of drawing edge is an important element of draw die design. If this radius is too small, tearing may occur, and if too great, wrinkling of the stock is to be expected. Preferred

APPLICATIONS OF TYPICAL ALUMINUM-BASE ALLOYS

Aluminum Co. of America Alloy Number	Forms Commonly Available													Heat-Treatable Alloy	CHIEF CHARACTERISTICS	TYPICAL APPLICATIONS
	Sheet and Plate	Wire	Rod and Bar	Rolled Shapes	Extruded Shapes	Tube and Pipe	Rivets	Screw Mach. Products	Forgings	Sand Castings	Perm.-Mold Castings	Die Castings	"Alclad" Sheet			
2S	●	●	●	..	●	●	●	..	.	..	..	..	..	.	Good forming qualities, resistant to corrosion, weldable.	Sheet metal work, chemical equipment, cooking utensils.
3S	●	●	●	..	●	●	●	..	..	..	.			.	Workability, weldability and resistance to corrosion.	Sheet metal work, decorative trim, gasoline tanks for aircraft.
11S	..	●	●	..	..		.	●	●	..	..	..	..	●	Good machinability, "free" cutting, good mechanical properties.	Screw-machine products.
14S	..	..	..	..	..	..	.	..	●	..			.	●	Highest strength and hardness of all aluminum alloys.	Heavy-duty forgings, power shovel bails, airplane fittings.
17S	●	●	●	●	●	●	●	●	●	.	.	.	●	●	Excellent mechanical properties. (Duralumin type alloy.)	Structural applications in construction and transportation fields.
A17S	..	..	..	..	..	..	●	..	..	..				●	Fair strength and cold-working properties.	Rivets.
18S	..	..	..	..	..	..	.	..	●	..	..			●	Good strength at elevated temperatures.	Forged aircraft-engine pistons.
24S	●	●	●	..	●	●	..	●	..	.	.	..	●	●	High strength, sensitive to heat-treatment.	Widely used in aircraft construction.
25S	..	..	..	..	..	.	.	..	●	.	..	.		●	Excellent workability when hot, high strength.	Complicated forgings.
32S	..	..	..	..	..	.	.	.	●	..	.	.		●	Comparatively low coefficient of thermal expansion.	Forged aircraft-engine pistons.
A51S	..	..	..	..	..	..	.	.	●	.	.	.	..	●	Excellent workability when hot, high strength.	Intricate forgings, machine and automotive parts.
52S	●	●	●	..	..	●	..	.	..	..	..	..	..	.	Highest strength of non-heat-treatable aluminum alloys, good workability and resistance to corrosion.	High-strength sheet metal work, marine and transportation applications.
53S	●	●	●	●	●	●	●	●	●	..	..	.		●	Fair mechanical properties, excellent resistance to salt-water corrosion.	Structures subject to severe corrosive conditions; naval, architectural and industrial applications.
61S	●	..	..	..	●	●	..	..	.	.	..		..	..	Good strength and workability.	General-purpose casting alloy.
13	..	..	..	..	..	.	.	..	..	..	●	●	..	.	Excellent foundry characteristics, good mechanical properties, resistant to corrosion.	General-purpose alloy for large, intricate parts.
43	..	..	..	..	.	.	..	..	..	●	●	●	..		Good foundry characteristics, weldability, good resistance to corrosion, pressure tightness.	Castings that must be leakproof under pressure, architectural trim, sewage disposal plants, pipe fittings.
47	.	..	..	..	..	.	.	.	.	●		.	.	★	Good foundry characteristics, improved mechanical properties over Alcoa 43 alloy.	High-strength intricate castings, leakproof castings.
81	..	..	..	..	..	.	.	.	.	.		●			Satisfactory foundry characteristics and mechanical properties for simple castings of moderate thickness.	Small, simple parts.
83	..	..	..	..	..	..	..	.	.	.	.	●	..	.	Good foundry characteristics, good ductility.	Parts requiring spinning or other forming operations.
85	.	..	..	..	..	..	.	.	.	..		●		..	Best combination of strength and ductility of the die-casting aluminum-base alloys.	Brackets, frames, levers with thick sections.
108	..	.	..	.	.	.	.	.	.	●				.	Good foundry characteristics, pressure tightness.	Manifolds, valves and other intricate castings requiring pressure tightness.
A108	.	..	..	..	..	.	.	.	.	..	●	..		..	Good foundry characteristics	Ornamental grilles, general-purpose castings.
112		..	..	..	..	.	.	.	.	●	●	.		.	Widely used general casting alloy; good casting and machining characteristics.	General-purpose castings, crankcases, oil pans, cylinder heads, differential carriers and other automotive applications.
B113	..	..	..	..	..	.	.	.	.	.	●	.		.	Good foundry characteristics, good machining properties.	Washing machine agitators, general-purpose castings.
C113	.	..	..	..	..	.	.	.	.	.	●	.		●	Modification of Alcoa B113 alloy with better pressure tightness.	Automotive-engine cylinder heads, general purpose castings.
122	..	..	..	..		.	.	.	.	●	●			●	High hardness, resistance to wear, useable at elevated temperatures.	Auto engine pistons, camshaft bearings, valve tappet guides.
A132	..	..	..	..	..	.	.	.	..	..	●			●	Low coefficient of thermal expansion, retains strength at high temperatures.	Pistons for internal-combustion engines.
138	..	..	..	..	..	.	.	.	.	..	●			.	Excellent hardness, which is retained at elevated temperatures.	Flatiron sole plates.
142	..	..	..	..	..	.	.	.	.	●	●	.		●	Retains strength at elevated temperatures, has good bearing characteristics.	Pistons and cylinder heads.
195	..	..	..	..	..	.	.	.	.	●	.	.		●	Good mechanical properties; resistant to salt-spray corrosion.	Machine bases and parts, shop crane trucks, trolley parts, outboard motors, ship castings, aircraft engine parts.
B195	..	..	..	..	..	.	.	.	.	.	●	..	..	●	Widely used modification of Alcoa 195 alloy.	Permanent-mold castings (products same as for Alcoa 195 alloy).
212	..	..	..	..	..	.	.	.	.	●	..	..		.	General-purpose casting alloy; has improved foundry characteristics over Alcoa 112 alloy.	General-purpose castings of intricate design.
214	..	..	..	..	..	.	.	.	.	●	..	.		.	Resistant to severe corrosive conditions, excellent mechanical properties.	Carburetor cases, machine parts, pipe fittings.
A214	..	..	..	..	..	.	.	.	.	..	●	..		●	Excellent mechanical properties, good resistance to corrosion and tarnishing.	Cooking utensils.
218	..	..	..	..	..	.	.	.	.	..	..	●	..	.	High mechanical properties, resistant to corrosion, easily finished.	Marine fittings, hardware.
220	..	..	..	..	..	.	.	.	.	●	..	.	..	●	Highest strength and shock resistance of casting alloys, good resistance to corrosion.	Aircraft fittings, railroad car parts, heavy-duty castings, power shovel dipper parts, marine applications.
A334	..	..	..	..	..	..	.	.	.	●	.	.		.	Better tensile properties than Alcoa alloys No. 108, 112 and 212.	Automotive-engine parts, air-brake valves.
335	..	..	..	..	..	.	.	.	.	●	●	.	..	●	Good foundry characteristics, resistant to corrosion, strong at elevated temperatures.	Cylinder heads and crankcases for Diesel and aircraft engines.
A335	..	..	..	..	..	..	..	..	..	●	..	.	..	●	Modification of Alcoa 355 alloy	Same as Alcoa 355 alloy for operating temperatures above 400 F.
356	..	..	..	..	..	.	.	.	.	●	..	.		●	Good foundry characteristics, weldability, pressure tightness, and resistance to corrosion.	High-strength, pressure-tight castings of intricate shape.
645	..	..	..	..	..	.	..	.	.	●	..	..		●	Good mechanical properties, low resist- corrosion.	Machine parts not subjected to elevated temperatures or corrosive conditions.

★ — Properties obtained by "modification" practice in the foundry.

radius of the edge of the punch is twice the thickness of the metal being drawn. Minimum draw radius on the die is about three times the metal thickness. Polished die and punch surfaces are best, since aluminum has a tendency to stick to the steel die surfaces.

Frequently, successful results in drawing or stamping operations depend on the lubricant used. A light mineral oil may be used for blanking and stamping operations. For deep-drawing, an oil of considerable body is required. The best lubricant is tallow, mixed with a small amount of mineral oil, but because of its cost and the greater difficulty of application and removal it is used only for the more difficult operations. The lubricant should be applied to both sides of the sheet.

IMPACT EXTRUSION

Virtually a "cold squirting" operation, impact extrusion of aluminum is possible only because of the high ductility of the metal. In this process slugs are placed one at a time in the cup-shaped die of a power press. Diameter of the die corresponds to the outside diameter of the part to be formed, while the diameter of the punch is the same as that desired on the finished part. The punch strikes the slug a single, downward blow with tremendous force, causing the metal in the slug to *squirt* up around the punch through the clearance between the punch and the die. The lower section of the die has the shape desired as the contour at the closed end of the part, and the lower end of the punch is shaped to conform to the contour desired inside the closed end of the part. When the punch is withdrawn, the part is stripped off.

A variation of the impact-extrusion process is the "Hooker" process for extruding small tubing with plain or modeled contours. This process reverses the usual impact method in that the metal is forced downward through an opening in the bottom of the die. The metal takes the shape between the cavity wall and the punch-point.

SPINNING

There is no essential difference in the process used for making spun articles of aluminum and aluminum alloys from that used for copper and brass, except that higher speeds (up to about 4,000 ft. per min.) are employed. Spinning is used for shaping round and oval symmetrical articles when quantities are too low to justify tools for other forming methods, or when the size or design is such as to make drawing difficult. The process is suitable only for commercially pure aluminum and a few of the more ductile alloys.

For most spun articles the amount of strain hardening is not enough to necessitate an intermediate anneal. In some complicated re-entrant forms it may be best to spin the part over first one chuck and then another, just as several draw dies sometimes are used. When the metal must be annealed before completing a spinning operation, a torch may be played on the partially spun piece while it is rotating in the lathe.

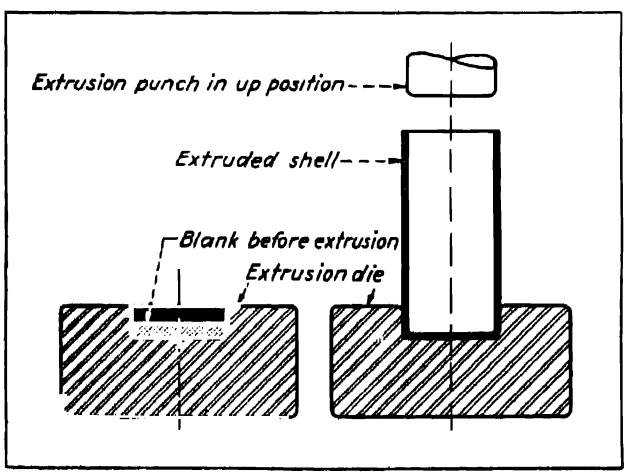
Aluminum sheet from 0.025 to 0.080 in. thick is spun with hand tools; a tool post is used in addition to hand tools when working on heavier sheet. Hickory sticks usually are employed for the breakdown of circles, then steel tools are used. While some operators need more tools than others, the three essential tools are a half-round former, a diamond-shaped trimmer and a beading tool. These are made of high carbon steel, forged to shape, hardened, polished, then fitted with hardwood handles.

Lubrication during spinning is important. Beeswax, tallow, and lard oil, mixed with white lead or vaseline, are suitable for small pieces. Ordinary yellow kitchen soap serves well when spinning large blanks which require heavy tool pressure. Speed of spinning depends on the size of the part and the severity of reduction—the rest depends on the skill of the operator.

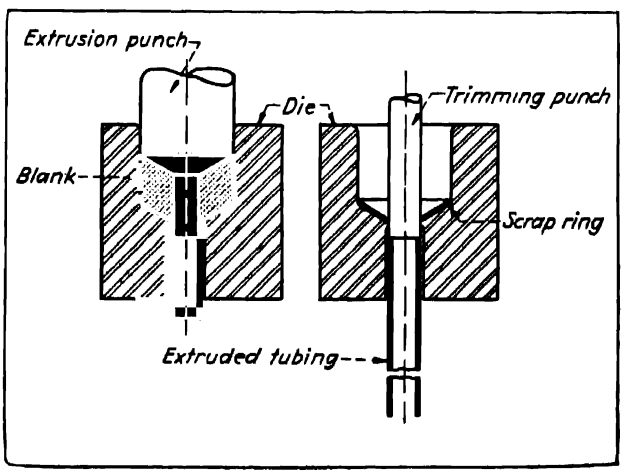
HAMMERING

When only a few pieces of a given shape are to be made, they frequently are made by hammering or "beating" instead of drawing or spinning. The hammering may be done with a wood mallet over a wood form, although pneumatic hammers sometimes are used. Usually the sheet is clamped to the form.

Occasionally sheets are formed under a high-speed hammer. The anvil and the mechanically driven hammer are curved slightly so that when the hammer hits the sheet it curves the metal. The operator, who must be highly skilled, moves the sheet between strokes of the hammer so that the desired dishing results. Comparison with a templet guides the operator.



When the punch strikes the slug in the impact-extrusion process the metal squirts through the opening between the punch and the die to form the desired part in one operation



Essentially the same as impact-extrusion, the Hooker process forms small tubing by forcing the metal in the slug to flow downward through an opening in the bottom of the die

HEAT-TREATMENT OF ALUMINUM ALLOYS

There are a number of aluminum-base alloys whose physical properties may be improved by heat-treatment. All of them may be softened after strain hardening by annealing at proper temperatures.

Hardening constituents in the heat-treatable alloys are elements whose solid solubility in aluminum is much higher at elevated temperatures than at room temperatures. Grain refinement is not a factor in improvement of properties by thermal treatment, as there are no phase changes in solid aluminum below the melting point. Heat-treatment simply is a means for distributing efficiently the alloying ingredients.

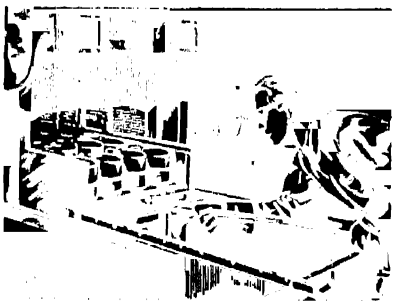
In ordinary commercial practice there are three types of thermal treating processes applied to wrought aluminum alloys. In certain cases these processes also are applied to some cast aluminum alloys.

ANNEALING

Strain hardening which results from cold working aluminum alloys may be removed by heating to permit recrystallization. Both batch furnaces and continuous furnaces can be used for the annealing operation. These furnaces may be of the full-muffle or semi-muffle design, and may be heated by oil, gas, or electricity.

Complete softening is almost instantaneous for most of the alloys hardened by cold working when heated to a temperature in the range of 640 to 670 F., but for Alcoa alloys 3S and 4S temperatures of 750 F. or higher are used. Heating for longer times at somewhat lower temperatures will accomplish similar results. Temperature of annealing is not critical, once the metal has reached the instantaneous annealing point, but it is desirable that the recommended values should not be greatly exceeded. Rate of cooling of non-heat-treated alloys from the annealing temperature is not important.

Care is required in determining annealing conditions for the heat-treatable alloys. While the metal must be raised to a temperature which will permit recrystallization, it must be maintained as low as possible in order to avoid heat-treatment effects which would prevent complete softening of the alloy, or the cooling rate must be so slow as to counteract the effect of such heating. Heating these alloys to 650 F. ordinarily is sufficient to remove the strain hardening which



results from cold working. This temperature should not be exceeded by more than ten degrees, nor should the metal temperature in any part of the load be less than 630 F. Rate of cooling is not important if the maximum temperature limit has not been exceeded, but slow cooling to about 450 F. is recommended in case any part of the load may have been heated above the recommended temperature.

This annealing practice, in addition to removing the hardening effects of cold working, also removes most of the effect of heat-treatment when applied to metal in the heat treated temper. If the metal must be completely annealed, as for severe forming operations, the heat-treated alloy must be heated for about two hours at a temperature of 750 to 800 F., and then allowed to cool slowly in the furnace to about 450 to 500 F. with a cooling rate under 50 F. per hour.

SOLUTION TREATMENTS

Solution heat-treatment of aluminum alloys commonly is carried out in molten salt baths or in air furnaces. The salt bath usually consists of fused sodium nitrate. The air furnaces used ordinarily are heated electrically. When small parts, such as rivets, are to be heat-treated, a small gas or oil heated pot of molten nitrate or lead frequently is used. The parts are placed in a steel tube with the bottom closed and the top covered, the tube being immersed in the bath to within a short distance of the top.

Accurate temperature control is necessary if proper results are to be obtained with heat-treatable aluminum alloys. Temperature limits for the solution heat-treatment are close and it is essential that these limits be adhered to. The temperature range for the solution heat-treatment of 17S and A17S is from 930 to 950 F. For 51S and 53S alloys, the temperature should be 970 F., making certain that the temperature is within ten degrees of this value. For alloy 24S, the temperature range is 910 to 930 F. Time of heating depends on the load, nature of the material and type of heating equipment. In a nitrate bath, a period of 25 min. usually is sufficient; somewhat shorter times have given satisfactory results. Where air is the heating medium, heating may require several hours.

QUENCHING

After the alloy has been heated for the required time for solution heat-treatment, it is removed from the furnace and quenched in cold water. Time interval between removal of the metal and its quenching should be as short as possible, not more than a few seconds, if best results are to be obtained. If the metal is permitted to cool in air during transfer to the quenching tank the resistance to corrosion may be impaired. Volume of quenching water should be sufficient that its temperature will not be raised above 150 F. by the heat of the load. When a nitrate heating bath has been used, it is necessary that any adhering nitrate be completely washed from the metal in order to avoid corrosion.

PRECIPITATION TREATMENTS

Precipitation heat-treatment, necessary for certain of the heat-treatable alloys, usually is carried out in an electrically heated oven or by means of steam coils, and provided with a fan for air circulation. For small articles an oil bath often serves adequately. The temperature range and time vary with different alloys. For Alcoa 61S and 53S, the preferred temperature limits are 310 to 320 F., and the aging time is eighteen hours. Aging for too long a time or at too high a temperature will lower the elongation and eventually the tensile strength of the alloy. If the temperature is too low, much longer aging periods are required to bring about the proper improvements of the alloys. Precipitation heat-treatment is often, but not always, preceded by the solution heat-treatment. The following precipitation treatments have been found suitable for the alloys indicated: Alcoa 25S, 4 to 15 hr. at 285 to 295 F.; Alcoa 195 (cast), 1 to 18 hr. at 310 to 320 F.

It is well to note that certain heat-treatment processes for aluminum alloys, and the heat-treatment of certain of the alloys, are subject to patent restrictions.

MACHINING PRACTICE FOR ALUMINUM

Compared with other commercial metals, aluminum and its alloys are machined readily. While tools used for steel sometimes will give good results, best practice is to use greater back and side rake angles. Frequently tools for aluminum alloys resemble those used in cutting hardwoods. High-carbon and high-speed tool steels ordinarily are satisfactory. Tools tipped with tungsten carbide show a marked improvement since their cutting edges remain sharp for long periods without grinding.

No matter what the material used for the tool, it is essential that the cutting edges be keen, smooth and free from grinding scratches, burrs or wire edges. Fine abrasive wheels should be used when sharpening; this should be supplemented by hand stoning. It is possible to machine aluminum and some of its alloys without a lubricant or cutting compound. Good practice, however, calls for the use of a cutting lubricant applied at the point of cutting.

It is important to remember that aluminum alloys in cast and wrought forms may be distorted under heavy machining cuts. Frequently special fixtures must be devised to hold the part so that distortion is reduced to a minimum. Ordinarily, it is best to use high speeds and fine to medium feeds. Recommended surface speeds vary widely, depending on the material from which the cutting tool is made, the characteristics of the part and the alloy from which it is made, and the rigidity of the cutting set-up.

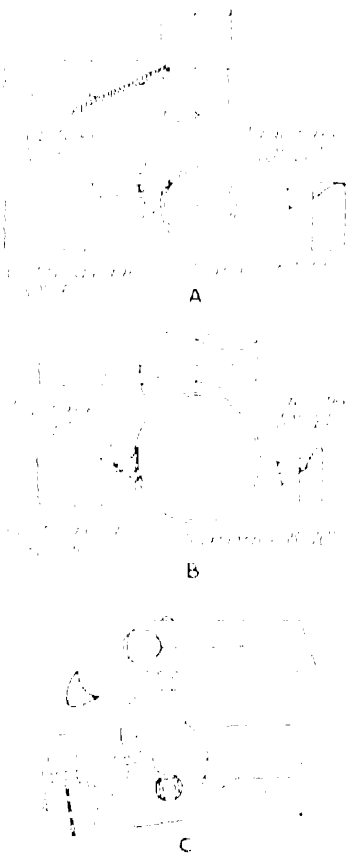
TURNING AND BORING

Tools satisfactory for most lathe operations are shown. In general, these tools should have appreciably more back and top rake than used for cutting steel. Their edges should be keen and smooth, and usually they should be set above the center line of the work to reduce any tendency to chatter. It is important that there be sufficient side and front clearance.

A round-nosed tool usually works best. The same tool may be used for finishing as for roughing, but just before finishing the edge should be restoned. Frequently, good results are obtained when the cutting edge of the tool is set considerably above center, up to about 45 deg. above the horizontal diameter. With such a setting, the chips, which should be long and straight, clear the work and the machine to better advantage.

Specific values for the angles to which the cutting edge of a tool should be ground must be governed by the work to be done and the requirements of the job. With high-speed tool steel tools, a back rake of 30 to 50 deg., a side rake of 10 to 20 deg., a total angle of cutting edge of 35 to 55 deg., and a front clearance of 6 to 8 deg. ordinarily will work well. In general, a top rake of 12 to 20 deg. and a front clearance angle of 3 to 4 deg. are sufficient for parting tools made of high-speed steel.

Cutting angles should be reduced to increase strength of the cutting edge when the operation involves considerable abuse, as when turning or facing lugs or bosses. Rake angles may be decreased when machining free-cutting alloys. Both top and side rake angles generally are increased when machining the "gummy" alloys.



A round-nose tool set carefully for proper clearance works best for engine lathe turning. The tool shown at A *works well on small diameters, while the tool at* B *is used for large diameters. Bit of tool shown at* C *is made from round stock, and is sharpened easily*

Maximum support of cutting edge is desirable on using carbide-tipped tools.

Feeds, speeds and tool shapes, together with suitable carbide grades, suggested by Carboloy for machining aluminum alloys, are tabulated. The values given are conservative; often the feeds and rake angles used in practice are in excess of those shown. Kennametal-tipped tools with back-rake angles of 20 to 27 deg. produce cleanly cut surfaces. A speed of 1,000 ft. per min. is possible on some jobs with grade KH Kennametal. Speeds of 300 to 1,500 ft. per min. are suggested for Vascoloy-Ramet tipped lathe tools when they are ground to have a clearance of 8 deg. and an effective rake angle of 8 to 15 deg. Grades 2A5, 2A7 and 2A9 tantalum-tungsten carbides are suitable for aluminum and its alloys. When the aluminum tends to build up at the cutting edge, Vascoloy-Ramet grade AT, which contains a higher percentage of tantalum carbide is used.

SCREW-MACHINE WORK

Both high-speed steel tools and carbide-tipped tools are used for screw machine operations. The two aluminum alloys commonly used for screw machine stock are Alcoa 11S-T3 and 17S-T. The 11S-T3 alloy cuts more freely than 17S-T, and it forms smaller chips. Cutting characteristics of the two alloys are similar with respect to surface speed, lubricant and types of tools used. Ordinarily, the 11S-T3 alloy is more flexible with regard to tool angles and tool feeds.

Generally, form tools are made for use without top rake, especially when machining Alcoa 11S-T3. For machining 17S-T alloy, a top rake of 5 deg. is advantageous in the production of a smooth finish. Both form and cut-off tools are made with a 0.5 deg. side clearance. Front clearance angles common in screw machine practice are satisfactory for these two alloys.

A chip curler groove frequently is ground in the cutting edge of box tools for Alcoa 17S-T alloy; no groove is necessary for the freer-cutting 11S-T3 alloy. For long, heavy cuts, it is advisable to put a series of small notches in the cams of the machine, thus providing an interrupted feed which breaks the turnings.

Tool feeds vary with cutting conditions, as well as with requirements of tolerance and finish. Overlapping operations and the condition of the

Milling cutters of both the solid and the inserted-blade types are used for aluminum alloys. Opinions vary as to best cutting angles, those shown have worked well in general practice

machine may require lower feeds than normal. Usually, cutting compounds used for other metals in screw machine practice are suitable for the free-cutting aluminum alloys.

PLANING AND SHAPING

Since work ordinarily can be set up securely for planing and shaping operations, cutting speeds for aluminum and its alloys ordinarily are limited only by the machine. Occasionally, heavy cuts possible in these operations will compensate to some extent for the necessarily low permissible cutting speed. The tool should be prevented from striking the finished work during the returned stroke. If this occurs, the work may be scratched and the thin cutting edge broken.

For light cuts, a round inserted-blade tool with a front clearance angle of 6 deg., a back rake of 45 deg. and a side rake of 8 deg. works well. Solid cutting tools should be used for the heavier cuts, especially when roughing. The tool shown for finishing cuts has a larger side rake angle than does the roughing tool, and the long sweep of the cutting edge produces a slicing action which cuts freely.

MILLING

Either solid-tooth or inserted-blade milling cutters work well on aluminum and its alloys. These cutters should be of the coarse-tooth helical type, and should have a considerable amount of top rake on the cutting edges. Nicked teeth assist in decreasing chip size. Face-milling cutters with inserted teeth should be designed so that the blades will have appreciable top and side rake.

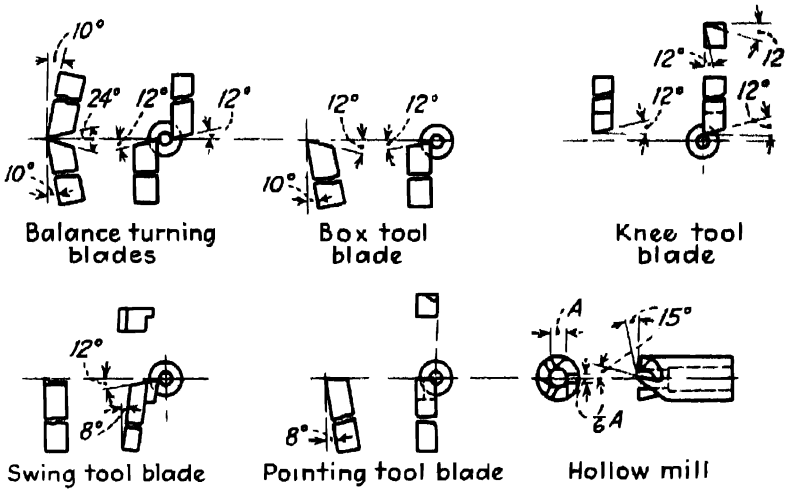
Milling speeds range from 500 to 1,500 ft. per min. with the feed per revolution approximately 1/500 of the surface speed. The softer and more ductile the alloy, the higher should be the cutting speed, feed and hook angles. For large work, tungsten-carbide-tipped inserted-blade cutters should be considered. Milling cutters with a rake angle of about 20 deg., a shear angle of 20 deg., and a clearance angle held close to 10 deg. generally prove satisfactory when milling aluminum alloys.

DRILLING

A so-called "fast helix" drill, with a 35 to 45 deg. helix angle of flute, works well when drilling aluminum, although standard twist drills sometimes are satisfactory. Flutes should be highly polished. An included point angle of 90 deg. is recommended for wrought aluminum alloys, while a 140 deg. point may be desirable in cast aluminum. In some instances a single flute drill with about 40 deg. helix, such as is used when drilling hardwood, works better than a two-flute twist drill. Lip clearance angle should be about 12 deg. Drilling speeds range from 150 to 300 ft. per min., depending on the type of drill, the alloy, and the depth of hole.

REAMING

Right-hand 7 to 10 deg. helical-fluted reamers for right-hand cut with radial cutting faces give very smooth holes in aluminum. Such a reamer has almost a burnishing action. The flutes must be highly polished to give a keen cutting edge if a good finish is to be obtained. One supplier of reamers suggests relieving the lands to a "white line" and then relief stoning the white line to the cutting edge. Speeds of 175 to 200 ft. per min. up to 1 in. diameter and 140 to



These screw machine tools made of high-speed tool steel usually work well on Brown & Sharpe automatics when machining "free cutting" aluminum alloys like Alcoa 11S-T3 and 17S-T

SPEEDS AND FEEDS FOR ALUMINUM ALLOYS

Depth of Cut	Max. Feed Per Rev.	Cast Alloys (As Cast) Wrought Alloys (Hard Rolled) Cutting Speed (Ft. per Min.)		Carboloy Grade	
Inch	Inch	Start	Range	Average Production	Quantity Production
1/64–1/32	0.010	350	300–500	883	905
1/32–1/16	0.020	300	250–350	883	905
1/16–1/8	1/32	200	150–300	883	905
1/8–1/4	1/32	125	80–150	44A	883

From starting speed suggested, cutting speed should be adjusted upward or downward, as necessary, within the range indicated to suit the conditions of the individual application. Under proper conditions, the speeds shown may be exceeded. These data apply when tool has a front clearance angle of 6-10 deg., a side clearance angle of 6-10 deg., a back rake of 5-15 deg., and a side rake of 8-15 deg.; with polished cutting edge.

CHARACTERISTICS OF WROUGHT AND CAST ALUMINUM-

TYPICAL ALUMINUM-BASE ALLOYS[1]				APPROXIMATE CHEMICAL COMPOSITION (Per Cent) (Aluminum and normal impurities constitute remainder of alloy)												Approx. Specific Gravity (Grams per cu. cm.)	Approx. Weight (Lb. per cu. in.)	Relative Resistance to Salt Water[7] (A = Highest Rating)	STRENGTH IN TENSION[4]				STRENGTH IN COMPRESSION[4]	
A. S. T. M. Designation		S. A. E. Alloy No.	Aluminum Co. of America Alloy No.	Copper	Silicon	Manganese	Magnesium	Zinc	Nickel	Chromium	Lead	Bismuth	Iron	Condition				Ultimate Tensile Strength (1,000 lb. per sq. in.)	Yield Strength[5] (1,000 lb. per sq. in.)	Elongation (Per Cent in 2 in.)		Yield Strength in Compression (1,000 lb. per sq. in.)	Shear Strength[6] (1,000 lb. per sq. in.)
Spec. No.	Alloy																			Sheet Specimen (1/16 in. thick)	Rod Specimen (1/4 in. diam.)		
Wrought Alloys																							
B 25-38T	.....	25	28-O	....	....	....	....	....	....	....	....	....	....	Annealed		2.71	0.098	A	13	5	35	45	5	9.5
B 25-38T	.....	25	28-H	....	....	....	....	....	....	....	....	....	....	Hard		2.71	0.098	A	24	21	5	15	21	13.0
B 79-38T	.....	29	38-O	....	....	1.2	....	....	....	....	....	....	....	Annealed		2.73	0.099	A	16	6	30	40	6	11.0
B 79-38T	.....	29	38-H	....	....	1.2	....	....	....	....	....	....	....	Hard		2.73	0.099	A	29	25	4	10	25	16.0
.....	.....	....	118-T3	5.5	....	....	....	....	....	....	0.5	0.5	....	H. T. & Aged		2.82	0.102	D	49	42	..	14	42	30.0
.....	.....	....	118-T8	5.5	....	....	....	....	....	....	0.5	0.5	....	H. T. & Aged		2.82	0.102	D	55	42	..	14	42	....
B 78-30T	.....	26	178-O	4.0	....	0.5	0.5	....	....	....	....	....	....	Annealed		2.79	0.101	D	26	10	30	22	10	18.0
B 78-30T	.....	26	178-T	4.0	....	0.5	0.5	....	....	....	....	....	....	H. T. & Aged		2.79	0.101	C	60	37	20	22	37	36.0
.....	.....	....	A178-T	2.5	....	....	0.3	....	....	....	....	....	....	Heat-Treated		2.74	0.099	C	43	24	24	27	24	26.0
.....	.....	24	248-O	4.6	....	0.6	1.5	....	....	....	....	....	....	Annealed		2.77	0.100	D	26	10	20	22	10	18.0
.....	.....	24	248-T	4.6	....	0.6	1.5	....	....	....	....	....	....	Heat-Treated		2.77	0.100	C	68	44	19	22	44	41.0
.....	.....	24	248-RT	4.6	....	0.6	1.5	....	....	....	....	....	....	Heat-Treated		2.77	0.100	C	70	55	13	..	55	42.0
B109-39T	.....	201	528-O	....	....	....	2.5	....	....	0.25	....	....	....	Annealed		2.67	0.096	A	29	14	25	30	14	18.0
B109-39T	.....	201	528-H	....	....	....	2.5	....	....	0.25	....	....	....	Hard		2.67	0.096	A	41	36	7	8	36	24.0
.....	.....	....	538-O	....	0.7	....	1.3	....	....	0.25	....	....	....	Annealed		2.69	0.097	A	18	7	25	35	7	11.0
.....	.....	....	538-W	....	0.7	....	1.3	....	....	0.25	....	....	....	Quenched		2.69	0.097	A	33	20	22	30	20	20.0
.....	.....	....	538-T	....	0.7	....	1.3	....	....	0.25	....	....	....	Heat-Treated		2.69	0.097	A	39	33	14	20	33	24.0
.....	.....	....	618-O	0.25	0.55	....	0.95	....	....	0.25	....	....	....	Annealed		2.70	0.098	B	18	8	22	22	8	12.5
.....	.....	....	618-W	0.25	0.55	....	0.95	....	....	0.25	....	....	....	Quenched		2.70	0.098	B	35	21	22	22	21	24.0
.....	.....	....	618-T	0.25	0.55	....	0.95	....	....	0.25	....	....	....	Heat-Treated		2.70	0.098	B	45	39	12	12	39	30.0
Forging Alloys																							
.....	.....	....	148-T	4.4	0.8	0.8	0.4	....	....	....	....	....	....	H. T. & Aged		2.78	0.101	C	65	50	10.0		50	45.0
.....	.....	....	178-T	4.0	....	0.5	0.5	....	....	....	....	....	....	H. T. & Aged		2.78	0.101	C	55	30	16.0		30	36.0
.....	.....	....	188-T	4.0	....	....	0.5	....	2.0	....	....	....	....	H. T. & Aged		2.86	0.103	D	55	35	10.0		35	....
.....	.....	27	238-T	4.5	0.8	0.8	....	....	....	....	....	....	....	H. T. & Aged		2.78	0.101	D	55	30	16.0		30	35.0
.....	.....	....	328-T	0.8	12.0	....	1.0	....	0.8	....	....	....	....	H. T. & Aged		2.68	0.097	B	52	40	5.0		40	38.0
.....	.....	280	A518-T	....	1.0	....	0.6	....	....	0.25	....	....	....	H. T. & Aged		2.68	0.097	B	44	34	14.0		34	32.0
.....	.....	....	538-T	....	0.7	....	1.3	....	....	0.25	....	....	....	H. T. & Aged		2.68	0.097	A	36	30	16.0		30	24.0
Sand Casting Alloys																							
B26-37T	JJ	35	43	....	5.0	....	....	....	....	....	....	....	....	As Cast		2.66	0.096	B	19	9	6.0		10	14.0
B26-37T	K	37	47[1]	....	12.5	....	....	....	....	....	....	....	....	As Cast		2.65	0.096	B	26	11	8.0		11	18.0
.....	.....	....	108	4.0	3.0	....	....	....	....	....	....	....	....	As Cast		2.75	0.099	D	21	14	2.0		14	20.0
B26-37T	C	33	112	7.5	....	....	....	2.0	....	....	....	....	1.2	As Cast		2.85	0.103	D	23	14	1.5		17	20.0
B26-37T	F	34	122	10.0	....	....	0.2	....	....	....	....	....	1.2	As Cast		2.85	0.103	D	26	21	0.5		..	25.0
.....	.....	34	122-T2	10.0	....	....	0.2	....	....	....	....	....	1.2	Annealed		2.85	0.103	D	25	20	1.0		20	21.0
.....	.....	39	142	4.0	....	....	1.5	....	2.0	....	....	....	....	As Cast		2.73	0.099	D	28	24	1.0		31	24.0
B26-37T	H	39	142-T61	4.0	....	....	1.5	....	2.0	....	....	....	....	H. T. & Aged		2.73	0.099	D	37	32	0.5		47	32.0
.....	.....	....	142-T571	4.0	....	....	1.5	....	2.0	....	....	....	....	Aged		2.73	0.099	D	32	28	0.5		34	27.0
B26-37T	G	38	195-T4	4.0	....	....	....	....	....	....	....	....	....	Heat-Treated		2.77	0.100	C	31	16	8.5		16	24.0
B26-37T	G	38	195-T6	4.0	....	....	....	....	....	....	....	....	....	H. T. & Aged		2.77	0.100	C	36	22	5.0		25	30.0
B26-37T	G	38	195-T62	4.0	....	....	....	....	....	....	....	....	....	H. T. & Aged		2.77	0.100	C	40	31	2.0		38	31.0
B26-37T	CC	36	212	8.0	1.2	....	....	....	....	....	....	....	1.0	As Cast		2.83	0.102	D	22	14	2.0		14	20.0
B26-37T	L	320	214	....	....	....	3.8	....	....	....	....	....	....	As Cast		2.63	0.095	A	25	12	9.0		12	20.0
.....	.....	324	220-T4	....	....	....	10.0	....	....	....	....	....	....	Heat-Treated		2.56	0.092	A	45	25	14.0		26	33.0
.....	.....	....	A334	3.0	4.0	....	0.3	....	....	....	....	....	....	As Cast		2.73	0.099	D	25	16	2.0		22	24.0
B26-37T	N	322	355-T4	1.3	5.0	....	0.5	....	....	....	....	....	....	Heat-Treated		2.68	0.097	C	30	20	5.0		23	28.0
B26-37T	N	322	355-T6	1.3	5.0	....	0.5	....	....	....	....	....	....	H. T. & Aged		2.68	0.097	C	35	25	3.5		37	30.0
B26-37T	N	....	355-T51	1.3	5.0	....	0.5	....	....	....	....	....	....	Aged		2.68	0.097	C	28	23	1.5		24	22.0
.....	.....	....	A355-T51	1.4	5.0	0.8	0.5	....	0.8	....	....	....	....	Aged		2.71	0.098	C	28	24	1.5		24	22.0
.....	.....	....	A355-T59	1.4	5.0	0.8	0.5	....	0.8	....	....	....	....	Aged		2.71	0.098	C	25	21	2.0		21	21.0
B26-37T	M	323	356-T4	....	7.0	....	0.3	....	....	....	....	....	....	Heat-Treated		2.65	0.096	B	28	16	6.0		18	22.0
B26-37T	M	323	356-T6	....	7.0	....	0.3	....	....	....	....	....	....	H. T. & Aged		2.65	0.096	B	32	22	4.0		22	27.0
.....	.....	323	356-T51	....	7.0	....	0.3	....	....	....	....	....	....	Aged		2.65	0.096	B	25	20	2.0		22	18.0
.....	.....	31	645	2.5	....	....	....	11.0	....	....	....	....	1.2	As Cast		2.94	0.106	D	29	20	4.0		20	22.0
Permanent Mold Casting Alloys																							
B108-38T	9A	35	43	....	5.0	....	....	....	....	....	....	....	....	As Cast		2.68	0.097	B	24	9	6.0		9	18.0
B108-38T	3	....	A108	4.5	5.5	....	....	....	....	....	....	....	....	As Cast		2.77	0.100	D	28	16	2.0		16	25.0
.....	.....	33	112	7.5	....	....	....	2.0	....	....	....	....	1.2	As Cast		....	0.104	D	27	19	1.5		19	23.0
.....	.....	....	B113	7.0	1.7	....	....	....	....	....	....	....	1.2	As Cast		2.86	0.103	D	28	19	2.0		19	23.0
B108-38T	2	....	C113	7.0	4.0	....	....	2.0	....	....	....	....	1.2	As Cast		2.86	0.103	D	30	24	1.0		24	22.0
.....	.....	34	122-T52	10.0	....	....	0.2	....	....	....	....	....	1.2	H. T. & Aged		....	0.104	D	35	31	0.5		31	25.0
B108-38T	6	....	A132-T4	0.8	12.0	....	1.0	....	2.5	....	....	....	0.8	H. T. & Aged		....	0.097	C	38	30	1.5		30	29.0
B108-38T	6	....	A132-T551	0.8	12.0	....	1.0	....	2.5	....	....	....	0.8	H. T. & Aged		....	0.097	C	36	28	0.5		30	24.0
B108-38T	5	....	138	10.0	4.0	....	0.2	....	....	....	....	....	1.4	As Cast		....	0.105	D	28	24	0.5		32	22.0
.....	.....	39	142	4.0	....	....	1.5	....	2.0	....	....	....	....	As Cast		2.77	0.100	C	34	24	1.0		26	24.0
B108-38T	11	39	142-T61	4.0	....	....	1.5	....	2.0	....	....	....	....	H. T. & Aged		....	0.100	C	47	42	0.5		46	31.0
B108-38T	11	39	142-T571	4.0	....	....	1.5	....	2.0	....	....	....	....	H. T. & Aged		....	0.100	C	40	34	0.0		34	26.0
B108-38T	1	....	B195-T4	4.5	3.0	....	....	....	....	....	....	....	....	H. T. & Aged		....	0.101	C	36	22	7.5		22	30.0
.....	.....	....	B195-T6	4.5	3.0	....	....	....	....	....	....	....	....	H. T. & Aged		....	0.101	C	39	33	5.0		23	32.0
.....	.....	....	A214	....	....	....	3.8	1.8	....	....	....	....	....	As Cast		2.68	0.096	B	27	16	5.0		17	22.0
.....	.....	322	355-T4	1.3	5.0	....	0.5	....	....	....	....	....	....	H. T. & Aged		....	0.097	C	38	23	6.0		23	29.0
.....	.....	322	355-T6	1.3	5.0	....	0.5	....	....	....	....	....	....	H. T. & Aged		....	0.097	C	43	26	4.0		26	30.0
Die-Casting Alloys																							
B85-39T	V	305	13	....	12.0	....	....	....	....	....	....	....	....	As Cast		2.66	0.096	B	33	18	1.8		..	....
B85-39T	IV	304	43	....	5.0	....	....	....	....	....	....	....	....	As Cast		2.68	0.097	B	29	13	3.5		..	....
B85-39T	XII	312	81	7.0	3.0	....	....	....	....	....	....	....	....	As Cast		2.85	0.103	D	32	24	1.3		..	....
B85-39T	VI	....	83	2.0	3.0	....	....	....	....	....	....	....	....	As Cast		2.75	0.099	C	30	14	3.5		..	....
B85-39T	VII	307	85	4.0	5.0	....	....	....	....	....	....	....	....	As Cast		2.78	0.101	C	35	19	2.7		..	....
.....	.....	....	218	....	....	....	8.0	....	....	....	....	....	....	As Cast		2.53	0.091	A	36	23	5.0		..	....

Notes:

[1] Properties of Alcoa Alloy No. 47 are obtained by special foundry practice called "modification."

[2] For all Alcoa alloys, wrought and cast, the following data apply: (a) Young's modulus of elasticity may be taken as 10,300,000 lb. per sq. in.; (b) Modulus of rigidity may be taken as 3,800,000 lb. per sq. in.; (c) Poisson's ratio is 0.33; (d) Bearing strength is equal to 1.8 times the tensile strength, provided the edge distance, in the direction of stressing, is not less than twice the diameter of the hole.

[3] Yield strength is the stress at which the material exhibits a permanent set of 0.2 per cent.

[4] Mechanical properties are obtained on A.S.-T.M. specimens. Since minimum guaranteed values vary with the commodity, these values are not given.

[6] Shearing strengths are single-shear values obtained from double-shear tests.

[6] Fatigue endurance values are based on withstanding 500 million cycles of completely reversed stress using the R. R. Moore type of machine and specimen.

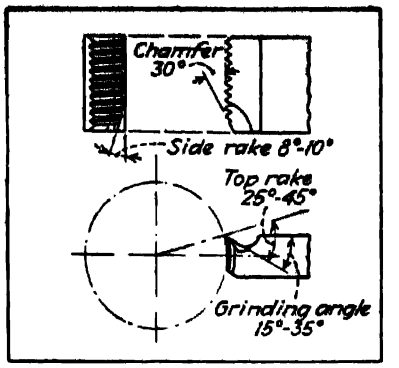
[7] An "A" rating is highest. Rating compares the stability of all aluminum-base alloys as a group, and is based on results of standard salt-

BASE ALLOYS

Fatigue Endurance Limit[1] (1,000 lb. per sq. in.)	Brinell Hardness (500 kg. load on 10 mm. ball)	Relative Suitability for Being Cold Worked[2]	Relative Suitability for Being Welded[2]		Relative Suitability for Being Brazed[2]	Relative Machinability[2]
			Gas and Arc	Resistance		
5.0	23	A	A	A	A	B
8.5	44	C	A	A	A	B
7.0	28	A	A	A	A	B
10.0	55	C	A	A	A	B
12.5	95	C	D	B	D	A
....	100	C	D	B	D	A
11.0	45	A	D	D	D	B
15.0	100	C	D	D	D	A
13.5	70	C	..	..	..	A
12.0	42	A	D	D	D	B
18.0	105	C	D	D	D	A
....	116	D	D	D	D	A
17.0	45	A	B	A	D	B
20.5	85	C	B	A	D	B
7.5	26	A	A	B	D	B
10.0	65	B	A	B	D	B
11.0	80	C	A	B	D	B
8.0	30	A	A	B	A	B
12.5	65	B	A	B	A	B
12.5	95	C	A	B	A	B
16.0	130	..	..	..	..	A
15.0	100	..	..	..	..	A
....	100	..	..	..	..	A
15.0	100	..	..	..	..	B
14.0	115	..	..	..	..	B
10.5	90	..	..	..	..	B
11.0	75	..	..	..	..	B
6.5	40	..	A	..	..	B
6.0	50	..	A	..	..	C
8.5	55	..	B	..	..	B
9.0	70	..	B	..	..	B
9.5	85	..	C	..	..	..
9.5	75	..	C	..	..	B
8.0	80	..	C	..	..	..
8.0	100	..	C	..	..	B
8.0	85	..	C	..	..	B
6.0	65	..	C	..	..	B
6.5	80	..	C	..	..	B
7.0	95	..	C	..	..	B
8.0	65	..	B	..	..	B
7.0	50	..	D	..	..	B
7.0	75	..	D	..	..	B
8.5	65	..	A	..	..	B
...	60	..	A	..	..	B
..	80	..	A	..	..	B
7.0	60	..	A	..	..	B
7.0	65	..	A	..	..	B
8.0	60	..	A	..	..	B
...	55	..	A	..	..	B
8.0	70	..	A	..	..	B
6.0	60	..	A	..	..	B
7.5	70	..	C	..	..	B
....	40	..	A	..	..	B
....	60	..	A	..	..	B
....	65	..	B	..	..	B
....	70	..	B	..	..	B
....	80	..	B	..	..	B
....	105	..	..	..	..	B
....	100	..	..	..	..	B
....	105	..	..	..	..	B
....	100	..	..	..	..	B
....	105	..	..	..	..	B
9.5	110	..	..	..	..	B
....	105	..	..	..	..	B
9.5	65	..	B	..	..	B
....	90	..	B	..	..	B
....	60	..	D	..	..	B
....	60	..	..	..	..	B
....	75	..	..	..	..	B
15.0	..	..	..	..	..	B
....	..	..	..	..	..	B
16.0	..	..	..	..	..	B
14.5	..	..	..	..	..	B
17.0	..	..	..	..	..	B
17.0	..	..	..	..	..	B

spray tests. However, under many conditions, alloys rated "D" are used with entirely satisfactory results; on the other hand, alloys rated "A" require protection in some exposures.

[2] Relative hot and cold workability, weldability, brazeability and machinability are indicated as follows: A = Excellent, B = Good, C = Fair, and D = Poor. Ratings are based on aluminum-base alloys as a group and are not to be used in comparison with other metals.



Thread chasers for self-opening die heads and collapsible taps should be ground as shown. Top rake angle should be greater for soft alloys and less for hard alloys

150 ft. per min. in larger sizes work well when the reamer is ground the same as for cast iron.

THREADING

Single-point threading of aluminum and aluminum alloys is an easy operation when the threading tool has considerable top and side rake and is fed into the work at a 30 deg. angle. When using a die head for threading these alloys, the chasers should be ground with a radial hook or sharp rake angle, particularly if the material is tough and stringy. Milled-thread die chasers for cast alloys generally are ground with a 5 to 10 deg. radial hook or rake angle for straight threading. A rake angle of 25 to 30 deg. works well with wrought alloys. Lapped chasers in threading dies produce smoother threads. Threading speeds range from 50 to 100 ft. per min. for standard threads. Special forms usually are cut at 20 ft. per min. As aluminum is comparatively soft, it is important that the die head be in proper alignment with the work when threading.

TAPPING

Hard surface-treated high-speed steel taps, with ground threads and highly polished flutes, a 5 to 18 deg. hook on the cutting edge, and about a 5 deg. hook on the heel, depending on the size of the tap, seem to operate best in aluminum. In sizes up to ½ in., taps with three flutes provide more chip space. In cast aluminum, the cutting face of the tap should be altered from a hooked cutting face to a straight rake. Suggested speeds range from 60 to 100 ft. per min.

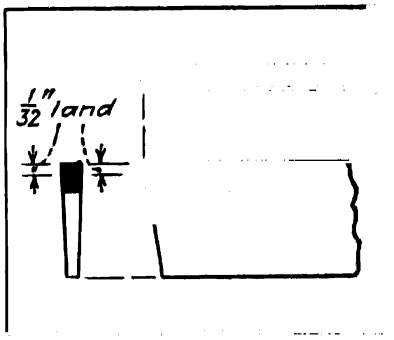
Application of proper cutting fluids will result in better size control, smoother and more accurate threads, with less tap sharpening. It is desirable to force the lubricant into the hole under pressure and parallel to the axis of the tap where conditions permit such an arrangement. This will facilitate chip removal. It is essential that there be sufficient space in the flute for the chips. Some users claim that helical-flute taps are unnecessary, except when tapping blind holes, or holes having a slot, providing the straight-flute taps are properly designed.

FILING

Where a considerable amount of stock is to be removed, a curved tooth file with coarse deeply cut teeth is recommended. For finish filing, especially on small work, a long-angle lathe file with 14 to 20 teeth per inch should be used. This file has a side rake of 45 to 55 deg., thus giving a more efficient cutting edge than can be obtained with single-cut files having a smaller side rake. The long angle helps force filings from the teeth. Chromium plating, if properly applied, will cause a file to work better, since the cuttings will not adhere to the plating surface. Rubbing chalk over file teeth or oiling them often helps prevent loading.

SAWING

Principles which govern design of cutting tools for aluminum and its alloys should be followed in selecting proper saws. Comparatively coarse teeth with curved gullets cut well. The teeth should be free from sharp corners and burred edges to reduce the possibility of chips stocking in the teeth. Alternate side-rake saws, or those having "chip-breaker" teeth may be used. For either type, a top rake or a "hook" of 10 to 25 deg.



Tipped with tantalum-tungsten carbide, this grooving tool is recommended for automotive pistons and similar work by Vasco-loy-Ramet

Form tools used on screw machines ordinarily have no back rake and are made with a one-half degree side clearance

will give the best cutting action Clearance of saw teeth is important, otherwise, the sides or the tips of the teeth will drag and so generate heat.

Circular saws for aluminum may be operated at peripheral speed of 10,000 to 15,000 ft. per min. Comparatively high speeds also are recommended for bandsaws. A fine feed should be used to avoid large cuttings. Tungsten carbide tipped saws are recommended for cutting aluminum alloys which contain substantial amounts of silicon.

Tooth spacing in bandsaws usually is about 4 or 5 teeth to the inch in the "hardened throughout" type, and either 6 or 8 teeth to the inch in the "flexible back" type. Hacksaw blades of the "wavy-set" type are satisfactory for cutting aluminum by hand, and the "curled chip" type is satisfactory for power hacksaw cutting. A cutting lubricant is necessary for some classes of work, such as cutting large heavy sections.

GRINDING

Wheel speeds above 6,000 ft. per min. have given good results when using silicon carbide wheels, but both wheel and work speeds should be set for the job at hand by an experienced operator. A solution of soluble cutting oil and water works well as a grinding compound. It is important that the fine grindings of aluminum be strained from the compound before reusing, in order to prevent deep scratches on the finished surface. For high finishes a slightly higher work speed than normal should be employed. Normal table traverse speeds should be used for roughing operations, but for the final finishing operation, the slower the table traverse speed the better.

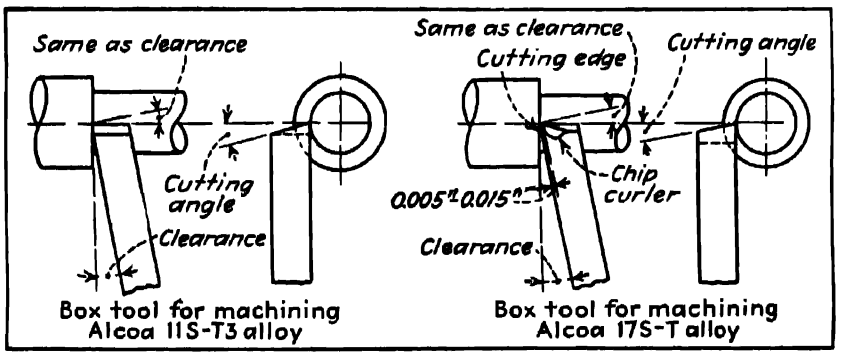
Generally speaking, a mechanical wheel dresser will work more satisfactorily than a diamond when aluminum or its alloys are being ground. It has been found that if the wheel is treated lightly with beeswax after truing, there is less tendency of the wheel to load with aluminum. The use of kerosene as a grinding coolant also helps to prevent loading.

CUTTING LUBRICANTS

Machining operations can be carried out successfully on some aluminum alloys without any lubricant or cutting compound; however, for best results some form of lubricant is desirable. Mineral-base lubricating oils thinned with kerosene frequently are used for most machining operations. It is reported that a number of plants are finding fuel oil satisfactory.

The nature of most machining operations or aluminum alloys makes it necessary that the cutting coolant employed be able to absorb the heat developed in the cutting operation. A light viscosity paraffin oil, kerosene, or a mixture of these two and a fatty oil, will leave a desirable finish. On some difficult threading operations, it has been found that small amounts of a sulphurized cutting oil, blended with a light paraffin oil, or used straight, will produce very smooth, high quality threads.

Beeswax may be used for tapping and threading. A mixture of beeswax, gasoline and turpentine made up into a paste works well for these operations. The use of turpentine is not advisable, since when the liquid evaporates it leaves a resinous deposit on the work. Soapy water gives good results in machining most of the aluminum alloys.



Box tool holders for screw machines hole blades at clearance angle of 8 deg. A notched cam helps break up chips under heavy cuts

JOINING PRACTICES FOR ALUMINUM

Both welding and brazing, as well as mechanical joining methods such as riveting and bolting, are employed in the fabrication of aluminum alloy structures. Choice of process depends on alloy used, stresses involved and service requirements. The technique for welding aluminum and its alloys is much the same as that employed for other common metals. Both fusion welding, in the form of torch and arc welding, and resistance welding, are used extensively in industry.

RIVETING

Riveting still is the most common method of joining aluminum, especially the heat-treatable alloys which depend on thermal treatment to develop high mechanical properties and, consequently, cannot be welded without sacrifice in strength. Riveting operation ordinarily is done cold. There should be clearance between rivet and rivet hole to allow for spread on heading up. It is important that a line of rivets should *not* be put in by working across the line consecutively from one rivet to the next.

Aluminum alloy rivets may be driven with squeeze riveters, or with hand or pneumatic hammers. No

matter which method is used, more pressure is required to drive the strong aluminum alloy rivets than is necessary to head hot steel rivets. Too light a blow will have a peening action on the rivet, and will not expand the shank in the hole.

The cone point driven head shown is recommended for aluminum alloy rivets. This head is large enough to develop the tensile strength of the rivet shank in a straight tensile pull, yet requires less driving pressure than a full button head. Degree of upsetting for the cone-point head is best controlled by checking diameters of driven heads, keeping them close to 1.5 times nominal shank diameter.

Rivet sets for aluminum alloy rivets should be smooth, polished surfaces, so that the metal may flow readily during forming. Bucking tools, espe-



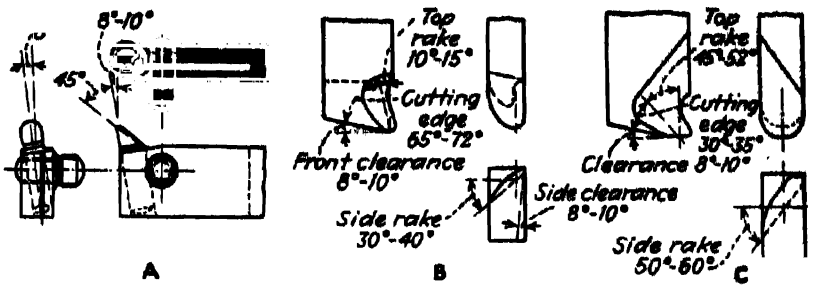
The cone-point driven head is recommended for aluminum-alloy rivets, as it needs less pressure

cially those used with the larger hammers, should have plenty of mass. Cup on bucking-up set should be slightly wider and shallower than the manufactured head, so that the initial contact will be at the end of the head, directly in line with the shank.

SOLDERING

Zinc- and tin-base solders can be used for aluminum and its light alloys, but the joints are subject to electrolytic corrosion unless adequately protected from moisture. For permanence, welding usually is preferred. The soldering of aluminum is better understood now than a few years ago, and this method of joining now has some applications for which it is satisfactory.

One procedure is to "tin" each of the surfaces to be joined by cleaning the surface thoroughly and heating it slightly above the melting point of the solder, then melting a small



A change in holder adapts the inserted-bit turning tool for planer and shaper applications as shown at A. *Solid tools shown at* B *and* C *work well for roughing and finishing operations*

amount of solder on the surface and rubbing with a wire brush. After tinning, the two parts are reheated, a little more solder is added if necessary, and the parts are pressed tightly together while still hot.

There now is available a solder and an Alcoa soldering flux which can be used to join aluminum and many of its alloys when using the soldering techniques commonly employed with other metals.

TORCH WELDING

Fusion welding with the oxyacetylene or oxyhydrogen torch is applicable for making articles from basic wrought and cast alloys, and for the repair of aluminum alloy castings. The oxyhydrogen flame generally produces a cleaner and more satisfactory joint. It usually will give sufficient heat for welding metal up to $\frac{3}{8}$ in. in thickness. Whether using hydrogen or acetylene, the torch should be adjusted carefully to show a neutral flame. This gives the best speed and economy, as well as a cleaner and sounder weld.

Production of a sound weld in aluminum involves the removal of the thin oxide film which otherwise prevents proper coalescing of the two surfaces of molten metal. This refractory film can be removed mechanically, or by the action of a suitable flux. Fluxes in general use are mixtures of salts, such as the chlorides, fluorides, and sulphates of sodium, potassium, lithium, calcium and aluminum in varying amounts.

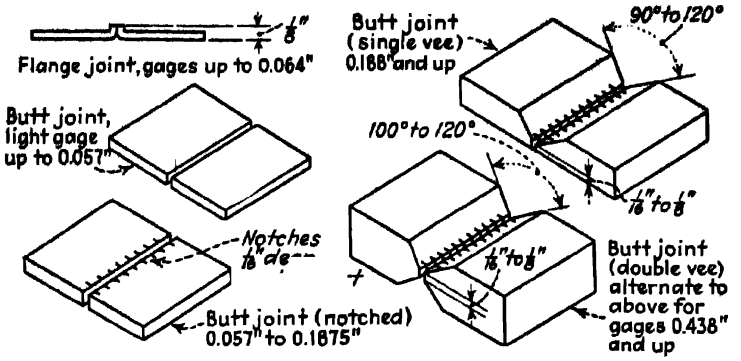
Proper selection of the welding rod is essential. Commercially pure aluminum and aluminum-manganese alloys ordinarily should be welded with pure aluminum wire, or with a rod of the same composition as the alloy. The parts being welded should be free to expand and contract during the welding operation. On other alloys and parts held in jigs, so that they are not free to move, an aluminum alloy rod containing 5 per cent silicon should be used.

Aluminum sheet $\frac{3}{8}$ in. or more in thickness, and large aluminum castings, should be preheated to 700 or 800 F. in order to avoid heat strains and to reduce the amount of oxygen and acetylene required for melting the seam. Also, if the base metal for some distance on either side of the seam is maintained at a temperature slightly below its melting point, the additional expansion caused by application of the torch is less likely to cause distortion of the work.

As soon as the torch weld is completed and the work has had time to cool, it should be washed thoroughly to remove all traces of flux. Most parts can be cleaned in boiling water if the joint can be reached with a brush. For inaccessible welds, cleaning can be done by first washing in hot water,

WHEELS RECOMMENDED FOR GRINDING ALUMINUM ALLOYS

Operation	*Abrasive Type*	*Abrasive Grit Size*	*Grade*	*Process*	*Wheel Speed Ft. Per Min.*
Snagging	Aluminum Oxide	20–36	Medium	Resinoid	5,000– 9,500
Cylindrical	Silicon Carbide	36–46	Soft	Vitrified	5,000– 6,000
Surfacing (cups or cylinders)	Silicon Carbide	24–30	Soft	Vitrified	4,500– 5,000
Internal	Silicon Carbide	36–46	Soft	Vitrified	5,000– 6,000
Cutting Off:					
Tubing and molding	Aluminum Oxide	80–120	Very Hard	Rubber	9,000–10,500
Gates and risers	Aluminum Oxide	24	Very Hard	Rubber	9,000–16,000



The above methods of preparing joints serve well when torch welding aluminum alloys. When using the metallic arc process, no preparation of the joint is necessary on sheet up to ¼ in. thick; the edges should be beveled to form a 90 deg. V with a ⅛ in. lip on thicker material

then immersing the part in a cold solution of 10 per cent sulphuric acid for 30 min. or in a 5 per cent solution of sulphuric acid held at 150 F. for 10 min.

In general, the technique of handling the torch, adjusting the flame and tip size is practically the same for torch welding heat-treatable alloys, as for the non-heat-treatable alloys. Often, where heat-treatable alloy parts are to be jig welded, it is best to tack weld and then loosen the jig clamps before completing the seam. In other cases it is sufficient merely to loosen the clamps immediately after completing the joint. Welding should be done in one pass.

ARC WELDING

The metallic arc welding process is particularly applicable in certain classes of work, since there is less buckling and warping of the work with arc welding than with torch welding. Preheating before welding can be eliminated to a large extent. Temper of the sheet is less affected during arc welding than during torch welding, since the heat is more concentrated and the weld is made more rapidly.

Metallic arc welding can be accomplished only with flux-coated electrodes. Such electrodes usually contain a filler wire composed of 95 per cent aluminum and 5 per cent silicon. Electrodes should not be stored for periods longer than six months. Excessive spatter of the arc when electrodes are used usually is caused by moisture in the flux coating. When this occurs the electrodes should be dried at a temperature between 200 and 300 F. for three or four hours.

For metallic arc welding of aluminum alloys, a steep volt-amp curve should be used. Both a.c. and d.c. arc welding machines are suitable. In setting up, the electrode usually is connected positive and the work negative. Ordinarily, a short arc is held. In starting an electrode, best results are obtained by "scratching" the electrode because, in some cases, the flux becomes fused over the striking end.

Should it be necessary to stop welding before a joint is completed, the slag must be removed from the crater and for a distance of approximately 1 in. beyond the crater before striking another arc. The new electrode is struck in the crater and the electrode is moved quickly back along the completed weld for about ½ in., and then welding proceeds as usual, making sure that the crater is completely remelted.

Best results ordinarily are obtained by using high currents and a high welding speed. Very little heat is dissipated into the base plate, consequently the molten metal is chilled and there may be some porosity along or just outside the line of fusion. If the plates are heated for some distance on either side to a temperature of 600 F., this porosity can be reduced or eliminated.

For butt welds, the work should be held in position by jig clamps and should be backed up by a copper plate. When butt-welding plates more than ⅛ in. thick, the copper backing plate should be grooved slightly beneath the joint to be welded. When making lap fillet welds, the general procedure is the same as that outlined above, except that the electrode should be manipulated with a small rotary motion, playing the arc first on the upper member, and then on the lower member of the joint.

Because of the manner in which a carbon arc weld is made, the process is not so generally applicable for welding aluminum and its alloys as is the metallic arc process. In general, its use is confined to butt joints and simple lap joints. In this process, the flux-coated welding rod is placed between the joint to be welded and the carbon electrode. Welding heat then is transmitted through the rod to the edges of the joint.

RESISTANCE WELDING

Resistance welding of aluminum and its alloys has been considered possible only during the past few years, but is already taking its place as an important fabricating process. The more commonly employed forms are spot, seam or line, and butt welding. It is important, from the standpoint of cost, that the oxide coating be removed, just before spot welding, so that surface heating will not occur when contact is made with welding electrodes.

Surfaces may be cleaned for spot welding in several ways. A fine grade of abrasive cloth, fine steel wool, or a fine scratch brush may be used when only a few parts are involved. Only the area contacted by the welding tips need be cleaned, except in cases where the parts have been heat-treated in nitrate; then it is desirable to clean one or both of the faying surfaces. The surfaces also may be cleaned with an etching solution.

During spot-welding, a molten zone is formed over a small area between the two aluminum sheets, directly between the electrodes. In order to keep pressure on this area at a minimum, one or both of the electrodes should establish only a point contact on its sheet. The conical point commonly employed has an included angle of 158 to 166 deg. Most spot-welding machines designed for other materials are not suited for use with aluminum alloys, since they do not provide a sufficiently high welding current for the work.

BRAZING

Methods of brazing aluminum alloy assemblies, announced only a year ago, make possible neat joints that require little finishing and cost less than gas or metallic arc welded joints in aluminum and its alloys. These processes employ certain low-melting point, aluminum-base alloys as a filler material, and a special flux which permits the filler to wet the surfaces of the joint. At present, brazing of aluminum alloy assemblies has been done by the furnace, torch and dip brazing methods.

A temperature range of 1,000 to 1,200 F. is suitable for most applications of furnace brazing. In this process, parts are assembled, fluxed, placed in the furnace, and raised to a temperature above the melting point of the filler material, but below the melting point of the part to be joined. Temperature control within 5 to 10 F. of the nominal value is essential for consistent results. In furnace brazing, the brazing alloy must be placed right at the joint before the assembly goes into the furnace. Clearance in the joint to be brazed is from 0.004 to 0.008 in.

Generally, it is sufficient to coat only the brazing alloy with flux, but in some cases best results are obtained by coating both the filler material and the part to be joined. When the furnace brazing operation has been completed, the coating of flux over and around the brazed joint must be removed to prevent attack of the metal if the part is to be used in contact with water.

FINISHES FOR ALUMINUM

For some products the "as-cast" and "as-worked" surface appearance natural to aluminum and aluminum alloy commodities are quite satisfactory. Often, however, it is desirable to apply one or more types of finish to the material in order to enhance its appearance, to increase its resistance to corrosion, and to protect the surface from abrasion. Finishes for aluminum and its alloys may be divided into four general classes, depending upon the manner in which they are applied. These are: (1) mechanical finishes, (2) chemical finishes, (3) electrochemical finishes, and (4) paint and lacquer finishes.

MECHANICAL FINISHES

By means of various mechanical finishes, the surface of an aluminum part can be freed from irregularities or scratches and, if desired, brought to a high lustre. Both hand and automatic mechanical equipment are used. Both portable and stationary tools are used for "snagging" castings and for removing large defects from aluminum parts by grinding. These rough-grinding operations can be done dry, but tallow or lard oil may be used when the operation requires. For most rough polishing, wheel speeds of 5,000 to 9,500 ft. per min. are used.

In general, polishing is accomplished in four steps: (1) roughing, (2) greasing or oiling, (3) buffing, and (4) coloring. The first two operations remove scratches and blemishes from the surface and prepare it for buffing. If the surface is smooth, it may be possible to eliminate either one or both of these operations. The four polishing operations differ primarily in the composition of the wheels, the abrasives, the methods by which the abrasives are applied, the speed at which the wheels operate, and the use of lubricants.

The high luster finish on the different types of aluminum is obtained by the two buffing operations. The first or "cutting down" operation differs from roughing and greasing in that the abrasive is imbedded in a grease binder and rubbed on instead of being glued to the face of the wheel. The final polishing operation, "coloring," usually is done with a loose wheel (made up of unsewed muslin or flannel disks), and the abrasive consists of lime or soft silica in a grease binder. Peripheral speeds may vary from 7,500 to 10,000 ft. per min.

A coarse lined scratch-brush finish may be obtained by the application of a rotating wire brush to the aluminum surface. Fineness of finish may be regulated by the size of the wires used in the brush. Dirt and grease first must be removed from the aluminum surface by rubbing it with air-slacked lime. Then it is held lightly against the edge of the revolving wire brush until the desired roughness is obtained. Ordinarily, low wheel speeds are used in order to eliminate excessive tearing of the metal surface. Satin finish is a modification of the scratch brush finish obtained by treatment of the metal with a finer wire brush wheel or by abrasives. Various effects may be obtained by changing the angle of contact of the surface with the wire brush.

Sandblasting is a rapid and inexpensive method for finishing aluminum. It gives a uniform matte surface appropriate for some articles. Usually, it is desirable to protect the sand-blasted surface by a lacquer or a clear varnish coating. Washed silica sand probably is the most commonly used abrasive for sand blasting aluminum. During the blasting, the nozzle is held at from 12 to 20 in. from the work and at an angle of 60 to 90 deg. with the surface. Motion of the nozzle in blasting should be in parallel lines extending the full length of the work.

Tumbling and burnishing operations frequently will produce a satisfactory finish. Burnishing produces a bright, fairly smooth surface by the action of steel shot rubbing against the parts. It is accomplished by tumbling the work together with the shot in a wood-lined barrel. Soap and water are added as a lubricant. For general work, $\frac{1}{32}$-in. steel balls are satisfactory, although other shapes such as cones, pins, slugs and disks may be used for special purposes.

CHEMICAL FINISHES

Low-cost protective and decorative finishes resistant to corrosion, but not particularly resistant to abrasion, can be obtained chemically. Such finishing methods include the frosted, chemical etching, and "Alrok" finishes.

The frosted finish has a silvery ap-

TYPICAL POLISHING PROCEDURES FOR ALUMINUM

Article	*Operation*	*Wheel*	*Composition*
SHEET COOKING UTENSILS	1. Buffing	Sewed muslin buff	Tripoli
	2. Coloring	Open muslin buff	Soft silica
SCREW-MACHINE PRODUCTS	1. Greasing	Felt or sheepskin	No. 180 emery
	2. Buffing	Sewed muslin buff	Tripoli
	3. Coloring	Open muslin buff	Soft silica
DIE CASTINGS	1. Greasing*	Glued rag wheel	No. 100 emery
	2. Greasing*	Felt wheel	No. 150 emery
	3. Buffing	Sewed muslin buff	Tripoli
	4. Coloring	Open muslin buff	Soft silica
SAND CASTINGS	1. Roughing	Glued rag wheel	No. 70 to 100 emery
	2. Greasing	Glued rag wheel	No. 100 to 220 emery
	3. Buffing	Sewed muslin buff	Tripoli
	4. Coloring	Open muslin buff	Lime

*May omit one or both.

pearance like that of finely etched glass, and is useful for finishing small or intricately shaped parts. It is not a permanent finish and needs further protection. The first step is to etch in a hot caustic soda solution. Immersion for 1 min. in a 15 per cent sodium hydroxide solution at 160-180 F. is frequently employed, although the concentration may vary from 2 to 25 per cent, and the bath may be heated to boiling. After etching, the metal is rinsed in clear cold water. If the time between the two steps is kept at a minimum, any liquid on the surface dries uniformly, and the danger of staining is minimized. Cold water is preferable to hot water, because it, too, lessens discoloration.

The third step is to immerse in strong nitric acid to neutralize any sodium hydroxide left on the surface. A satisfactory solution is made by mixing two parts of concentrated nitric acid with one part of water. However, concentrations as low as ten per cent are sometimes used. Following the nitric acid dip, the article is rinsed in clear, cold water, and then dried on a steam table.

ELECTROLYTIC FINISHES

The oxide finishes formed by anodic treatment in various electrolytes comprise one of the most important classes of finishes for aluminum. The hard corundum-like anodic coatings, which can be formed only on aluminum, are among the most durable of known finishes, and give protection and permanence to the surface. They are attractive in appearance, have high resistance to corrosion, high dielectric strength, high reflectivity, and good absorption for dyes and mineral pigments. Properties of the coatings vary, depending on the composition of the alloy, the composition of the electrolyte, and the temperature and voltage of operation, as well as the time of treatment. The patented "Alumilite" process is the most practical of the anodic treatments. It comprises anodic treatment of aluminum in a suitable electrolyte to secure a dense, adherent coating of aluminum oxide.

Electroplates on aluminum, such as bright chromium, nickel and oxidized copper, brass and silver, are used primarily for their appearance and the resistance to wear which they afford. These electroplates, while they are perfectly satisfactory where the corrosion conditions are not too severe, may not be satisfactory for continuous outdoor exposure.

Chromium applied directly on aluminum has several desirable characteristics. The coatings are ornamental, have high resistance to abrasion and resist alkaline solutions particularly well. Zinc electroplated on aluminum has been used to improve the electrical contact characteristics of the aluminum surface. Zinc or cadmium electroplates have also been used to increase the life of aluminum in certain corrosive environments.

The solutions and technique employed for electroplating on aluminum are much the same as for other metals. The important difference lies in the surface preparation before plating. Aluminum and aluminum alloys require special surface treatment if the electroplate is to show good adhesion or service, particularly where there is occasional exposure to moisture.

PAINTS AND LACQUERS

The use of paint or lacquer finishes on aluminum may be found desirable, or even necessary, for certain applications. In some instances, paint constitutes the most economical type of decoration that can be employed, while in other cases its use is desirable from the standpoint of protection, especially where severe conditions of exposure are encountered.

When a paint or lacquer coating is to be employed solely for decoration, very little special preparation is needed. The surface must, of course, be clean and free from grease if satisfactory adhesion is to be obtained. Often a thorough cleaning with solvent is sufficient.

When painting is done for protection, greater precautions must be taken, just as in the case of other metals. Adequate preparation of the surface is important, as is the selection of a satisfactory primer. Different alloys of aluminum behave somewhat differently with respect to their ability to hold paint, but in all cases aluminum alloys are easier to protect with paint than are most other metals.

One of the most effective of the simple chemical treatments employs a dilute aqueous solution of phosphoric acid. These solutions usually contain alcohol or other organic solvents in addition to phosphoric acid; sometimes chromates are added. Apparently they form a thin film of aluminum phosphate on the surface, which is quite inert and which tends to protect the aluminum and promote paint adhesion. There is a variety of proprietary treatments of this type available. Where simple cleaning of the aluminum is sufficient, inhibited alkaline solutions of the sodium phosphate type are frequently employed.

Alrok coatings, which are by a chemical treatment method, provide an excellent base for the application of paint. In combination with a suitable painting system, they make an excellent surface finish where the structure is to be subjected to severe exposure conditions, particularly continued high humidity or intermittent immersion in water. For severe service of this type, some of the anodic coatings are even better. The Alumilite finishes provide corrosion-resistant, adherent, impervious oxide films which constitute ideal bases for paint.

Brushing, dipping and spraying methods of applying paint finishes may be employed with aluminum. In addition, application by roller coating is particularly advantageous, especially where the metal is to be subsequently formed into various shapes. While it is not necessary to employ any special painting practice for applying decorative coatings to aluminum, a carefully selected painting system must be employed for protective coatings. The value of the system will depend to a large extent on the selection of the proper primer. The primer should have good resistance to moisture penetration to prevent surface reactions, should adhere well, form a good base for second coats, and should contain an inhibitive pigment.

Once the primer is properly applied, almost any durable exterior paint or enamel may be employed for the finishing operation. These include oil base paints, long oil varnishes and enamels, synthetic resin finishes, and aluminum paint made either with a long oil varnish or with a synthetic resin varnish. The synthetic resin enamels have been found effective as finishing coats because of their durability. Bituminous paints may also be used for finishing aluminum, but a primer of the same material is recommended in this case.

Much of the available data concerning the characteristics, applications and common methods of fabricating aluminum-base alloys has been summarized in this discussion. No attempt has been made to list all of the alloys available, those selected being typical alloys of wide application. Part of the data used has appeared in the Metals Handbook, 1939 edition, published by the American Society for Metals; in the 1940 S.A.E. Handbook published by the Society of Automotive Engineers; in specifications published by the American Society for Testing Materials; and in literature of companies which have cooperated in the preparation of this material. Reference sources consulted include Mark's Mechanical Engineers' Handbook, American Machinists' Handbook, Kent's Mechanical Engineers' Handbook, "The Metallurgy of Aluminum and Aluminum Alloys" by Robert J. Anderson, "The Aluminum Industry" by Junius D. Edwards, Francis C. Frary and Zay Jeffries, and Johnson's Materials of Construction, eighth edition.

Selection of V-Belts

RATINGS of V-belts have recently been revised by the industry to provide more uniform belt life with most economical installation cost. It has been known that the size of sheaves had an effect on the life of the V-belt but radically different results were obtained in installations which seemed similar, since allowances were made mostly by empirical means. A formula was developed by R. F. Vogt, chief consulting engineer of Allis-Chalmers Manufacturing Company, which includes not only the tension and centrifugal forces of early formulas but also accounts for the bending stresses as the V-belt passes around the small sheave. The ratings given here are based on this new conception.

High starting torques of some types of electric motors, vibration, and other peculiarities of installation have made it necessary to introduce service factors for best life. These are given in the tables, and the method of applying them is shown in the example.

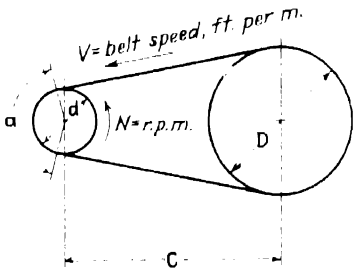


Table 1—CORRECTION FACTORS—BELT-CONTACT ARCS

Arc of Contact	Correction Factor	Arc of Contact	Correction Factor
180 deg.	1.00	130 deg.	0.86
170 deg.	0.98	120 deg.	0.83
160 deg.	0.95	110 deg.	0.79
150 deg.	0.92	100 deg.	0.74
140 deg.	0.89	90 deg.	0.69

Table 2—HORSEPOWER RATING OF V-BELTS

Belt Section	Pitch diam., in.	Belt speed, ft. per min. 1500	2500	3500	4500
		Hp. of single belt			
A	2.6	0.8	1.1	. . .	. . .
	3.0	1.0	1.5	. . .	. . .
	3.4	1.1	1.7	. . .	. . .
	3.8	1.3	2.0	2.5	. . .
	4.2	1.4	2.1	2.7	. . .
	4.6	1.4	2.3	2.8	3.2
	5.0 & up	1.5	2.4	3.0	3.4
B	5.0	1.8	2.8	3.4	3.5
	5.4	2.0	3.1	3.8	4.0
	5.8	2.1	3.3	4.1	4.4
	6.2	2.3	3.5	4.4	4.8
	6.6	2.4	3.7	4.7	5.1
	7.0 & up	2.5	3.9	4.9	5.4
C	7.0	2.9	4.5	. . .	. . .
	8.0	3.6	5.7	7.1	. . .
	9.0	4.2	6.6	8.4	. . .
	10.0	4.6	7.3	9.4	10.7
	11.0	5.0	8.0	10.3	11.8
	12.0 & up	5.3	8.5	11.0	12.7
D	12.0	6.5	10.1	12.4	. . .
	13.0	7.5	11.6	14.6	. . .
	14.0	8.2	12.9	16.5	. . .
	15.0	9.0	14.1	18.1	20.3
	16.00	9.6	15.1	19.5	22.1
	17.0 & up	10.1	16.0	20.7	23.5
E	20.0	11.7	18.3	23.0	. . .
	21.0	12.5	19.6	24.9	. . .
	22.0	13.2	20.8	26.6	. . .
	23.0	13.9	21.9	28.1	31.7
	24.0	14.5	23.0	29.5	33.5
	25.0	15.1	23.9	30.8	35.2
	26.0	15.6	24.7	32.0	36.7
	27.0	16.1	25.5	33.1	38.2
	28.0 & up	16.5	26.3	34.2	39.5

Formulas to Use

Let V = belt velocity, ft. per min., L = belt length, in.; C = distance between pulley centers, in.; D = diameter of driven sheave, in.; d = diameter of sheave on motor shaft, in.; N = motor-sheave speed, r.p.m.; Hp_b = required horsepower rating of belt; Hp_m = motor horsepower; F_s = service factor; F_c correction factor for arc of belt contact; and a = arc of belt contact. Then

$$V = 3.14(d/12)N$$

$$L = 2C + 1.57(D+d) + [(D-d)^2/4C]$$

$$a = 180 - [60(D-d)/C]$$

$$C = (b + \sqrt{b^2 - 32c})/16$$

$$Hp_b = (Hp_m \times F_s)/F_c$$

wherein $b = 4L - 6.28(D+d)$, and $c = (D-d)^2$. The correction factors can be interpolated from the tables.

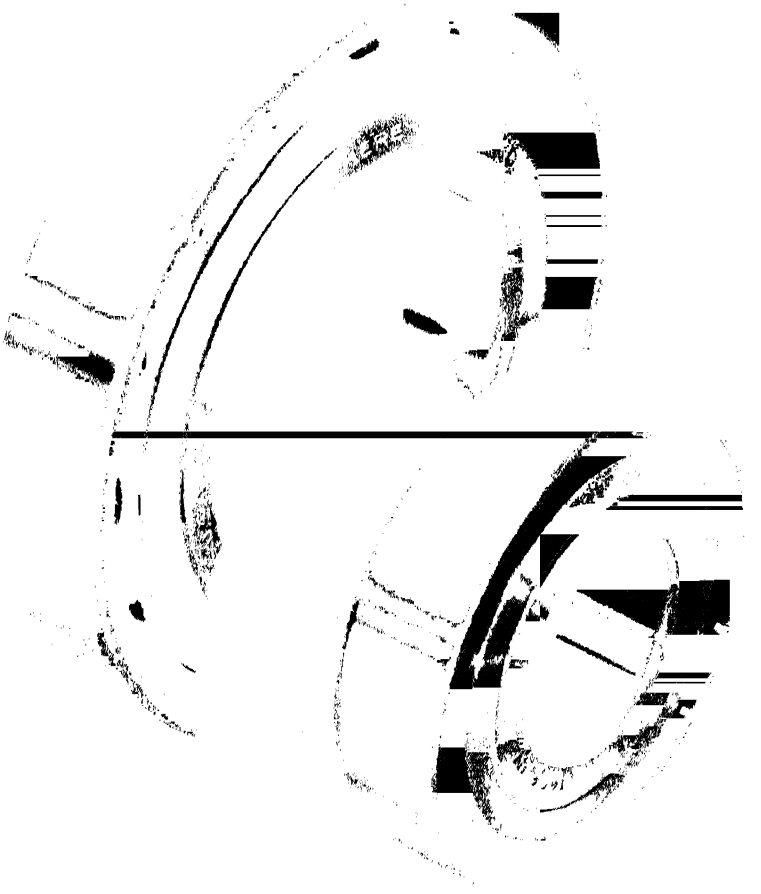
The following example shows how these formulas are applied: Find the number and length of C-section belts for driving a centrifugal fan at 415 r.p.m. with a 25-hp., 1160-r.p.m., a.c. motor. The sheave on the motor shaft is 11 in. diameter, while the sheave on the fan is 30.8 in. diameter. The distance between sheave centers is 50 in.

Substituting in the formulas, V = 3,340 ft. per min., L = 167.586 in. (use nearest length furnished by suppliers); and the arc of belt contact = 156.24 deg. From Table 3, page 635 the service factor F_s = 1.1. The correction factor for the arc of belt contact, interpolated from Table 1, is 0.94. The total required horsepower rating of the belts is (25x1.4)/0.94 = 37.4 hp. By interpolation from Table 2, it is found that a C-section belt running at 3,340 ft. per min. over an 11 in. sheave is good for approximately 10 hp.; therefore, the number of belts required is 37.4/10 = 3.74—use four belts.

Companies cooperating in establishing the ratings and service factors include

Allis-Chalmers Manufacturing Company
American Pulley Company
Browning Manufacturing Company
Dayton Rubber Company
R. & J. Dick Company
Dodge Manufacturing Company
Fort Worth Steel & Machinery Company
Gates Rubber Company
L. H. Gilmer Company
Golden's Foundry & Machine Company
B. F. Goodrich Company
Goodyear Tire & Rubber Company
W. A. Jones Foundry & Machine Company
Worthington Pump & Machine Corporation
Manhattan Rubber Mfg. Division of Raybestos-Manhattan, Inc.
Medart Company
Pyott Foundry & Machine Company
Rockwood Manufacturing Company
U. S. Rubber Company
T. B. Wood's Sons Company

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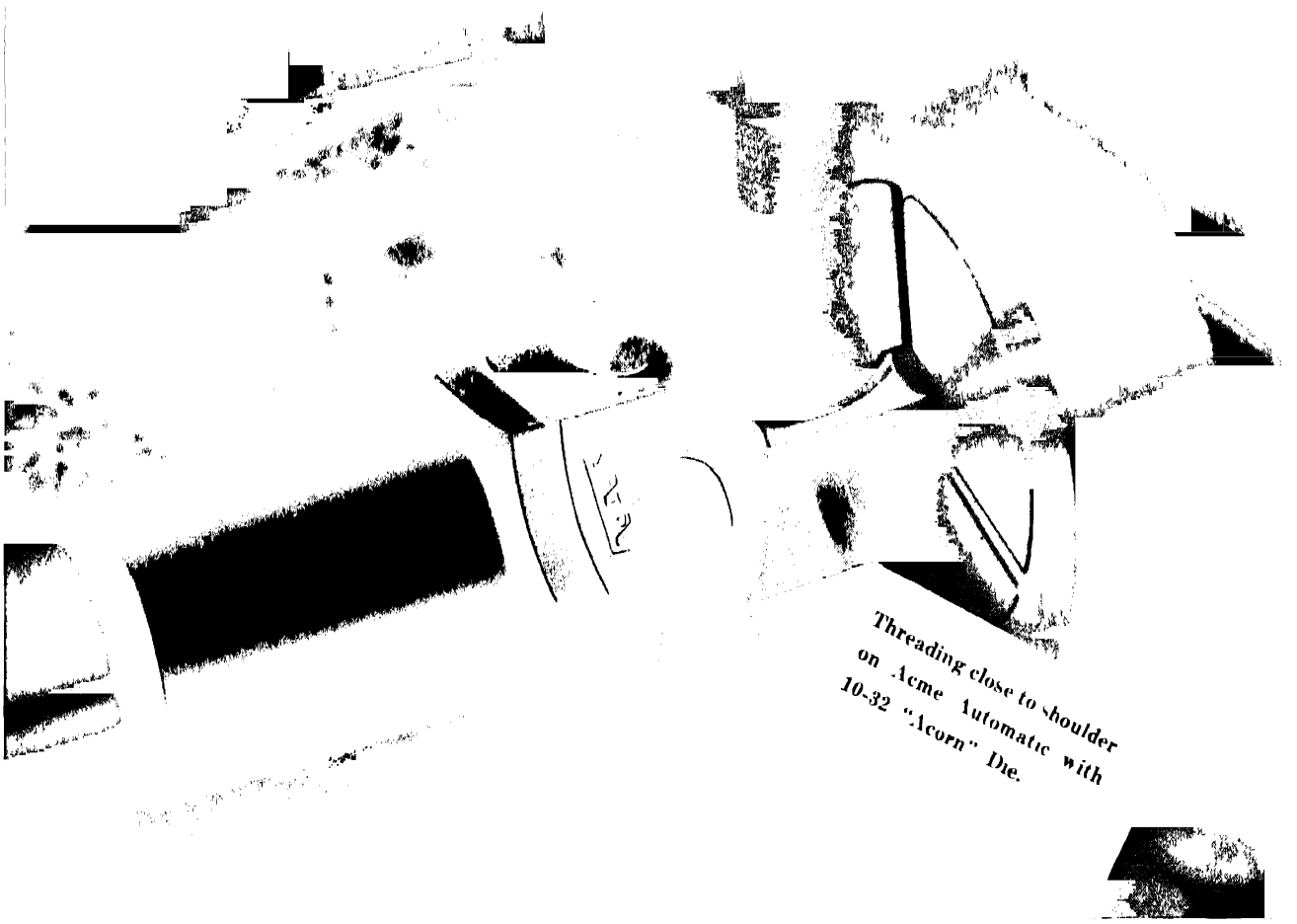
NEW DEPARTURE

THE FORGED STEEL BEARING

Selection of V-Belts

Table 3—SERVICE FACTORS

APPLICATIONS	ELECTRIC MOTORS										ENGINES		
	a c								d c		Gas and diesel		
	Squirrel cage			Wound rotor slip ring	Synchronous		Single phase						
	Normal torque line start	Normal torque compensator start	High torque		Normal torque	High torque	Repulsion and split phase	Capacitor	Shunt wound	Compound wound	4 or more cyl Above 600 r p m	Steam	Line shafts and clutch starting
COMPRESSORS													
Centrifugal	1 2	1 2		1 4	1 1				1 2		1 2		
Rotary	1 2	1 2		1 4	1 4		1 2	1 2	1 2		1 2		
Reciprocating													
3 or more cyl	1 2	1 2		1 4	1 4				1 2				
1 or 2 cyl	1 4	1 4		1 5	1				1 2				
CONVEYORS													
Apron		1 4	1 6						1 4				1 6
Belt ore coal sand		1 2	1 4						1 2				1 4
Belt (light package		1 0	1 1						1 0				1 2
Oven		1 0	1 1						1 0				1 2
Screw		1 6	1 8						1 6				1 8
Bucket		1 4	1 6						1 4				1 6
Pan		1 1	1						1 4				1 6
Flight		1 6	1 8						1 6				1 8
Elevator		1 4	1 6						1 4				1 6
FANS AND BLOWERS													
Centrifugal	1 2	1 2		1 4					1 2		1 2		
Propeller	1 4	1 4	2 0	1 6		2 0			1 4		1 4		
Induced draft	1 2	1 2		1 4					1 4		1 4		
Positive blowers	1 6	1 6		2 0	2 0	2 0					1 6		
Exhausters	1 2	1 2		1 4					1 4			1 5	1 5
GENERATOR AND EXCITERS	1 2								1 2		2 0	1 4	1 4
LINE SHAFTS	1 4	1 4		1 4	1 4	2 0	1 4	1 4	1 4	1 4	1 6	1 6	1 6
MACHINE TOOLS													
Grinders	1 2			1 4			1 2	1 0	1 2	1 2			
Boring mills	1 2			1 4					1 2	1 2			
Lathes	1 0			1 2			1 0	1 0	1 0	1 0			
Milling machines	1 2			1 4					1 2	1 2			
Screw machines	1 0			1 0			1 0	1 0	1 0	1 0			
Cam cutters	1 0			1 0					1 0	1 0			
Planers	1 2			1 4			1 2	1 0	1 2	1 2			
Shapers	1 0			1 0			1 0	1 0	1 0	1 0			
Drill presses	1 0			1 0			1 0	1 0	1 0	1 0			
Drop hammers	1 0			1 0			1 0	1 0	1 0	1 0			
Shears	1 2			1 4			1 2	1 2	1 2	1 0			
MILLS													
Pebble		1 4	1 6	1 4						1 4			1 6
Rod		1 4	1 6	1 4						1 4			1 6
Ball		1 4	1 6	1 4						1 4			1 6
Roller mills		1 4	1 6	1 4						1 4			1 6
Flaking mills		1 6	1 6	1 4						1 4			1 6
Tumbling barrels		1 6	1 6	1 4						1 4			1 6
PUMPS													
Centrifugal	1 2	1 2	1 4	1 4			1 2	1 2					
Gear	1 2	1 2	1 4	1 4			1 2	1 2					
Rotary	1 2	1 2	1 4	1 4			1 2	1 2	1 2		1 2		
Reciprocating 3 or more cyl	1 2	1 2		1 4	1 4	1 6					1 8	1 8	
1 or 2 cyl	1 4	1 4		1 6	1 6	1 8					2 0	2 0	
Dredge pumps	1 4	1 4		1 4							2 0	2 0	



Threading close to shoulder on Acme Automatic with 10-32 "Acorn" Die.

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Every year more manufacturers turn to genuine "Acorn" Dies because of the way they handle jobs like this one. This 10-32 High Speed Steel "Acorn" Die on a multiple spindle automatic is threading safety razor handles. Sustained accuracy and ability to cut close to a shoulder are essential requirements. "Acorn" Dies fill the bill, to the tune of over 15,000 threaded parts per die! G. T. D. Greenfield was the originator of the "Acorn" Die—the die with positive concentric adjustment. G. T. D. Greenfield engineers know how and where "Acorn" Dies can be most advantageously used. This picture shows how compact the "Acorn" Die is—shows how close to a shoulder it will cut. Remember, too, they operate equally well on fixed or live spindles. Ask your supply house or G. T. D. Greenfield for full data.



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No Substitute for Time

MUCKRAKING of the defense program has begun. It is directed against industry as the big bad wolf, with the government in the role of Little Red Riding Hood.

Screaming at prospective readers from the newsstands a week ago was an eight-column scare head "Strike of Capital Delays National Defense" on the first page of *The New York Post*. The next day appeared another streamer head "Plane Firms Spurn Contracts to Lobby for Higher Profits." The articles were part of a series to expose the reasons for delays in the defense program.

Concludes an editorial comment in the same paper, "The war industries have had a three-month trial under a wholly voluntary system. Some of the most vitally needed groups have failed to meet the test. Now is the time for the selective draft of industry."

If we choose to chalk up this attack on industry to ignorance rather than to malice, it demonstrates one vital point. The fact must be driven home to the public that you can't press a button and have tanks instead of automobiles roll off a line.

As yet the United States does not have war industries. The government and manufacturers are feverishly trying to create such industries. That effort consists of establishing new plants to make war materiel heretofore made only in government arsenals or not at all, and converting existing plant facilities from production of peacetime goods to fabrication of wartime goods.

No matter how you look at it, that is a gigantic task. It takes time. And for time there is no substitute. When we recently asked a high-ranking military officer how long it would take to get going, he answered unhesitatingly, "Two years." It may be possible to shorten that time period, but not much.

It is more likely to be lengthened if the administration should repeat its performance in connection with amortization of new defense plants. Who can blame industry for reluctance to invest its capital in new factories designed solely to meet defense needs, if it must continue to pay taxes on them perhaps long after their useful function has ceased?

Industry might well ask, "How long will the defense fever last?" Nobody is able to answer. After the World War it ceased abruptly. It can do the same thing again. What guarantee does industry have that it will not be left "holding the bag?" Even *The New York Post* concedes that industry should be protected against loss.

Yet when industry tried to secure legislation authorizing the quick writing off of plant investments for defense, Secretary Morgenthau bitterly opposed it for weeks. Over the pleas of his defense chiefs the President insisted on tying together amortization and excess profits in the same bill. Altogether a sixty days' delay has occurred.

There have been other delays in which industry has had no part. First the military authorities want one tank design, then another. In some cases the desire to put into a war product all the experience learned to date from the European war has outrun the practical consideration that a thousand units slightly outmoded are worth a thousand times more than one up-to-date unit which has never left the drawing board.

Many industrialists are disturbed because of the slowness with which orders have come out of Washington. They realize that the uninformed public soon will be asking, "Where are all the airplanes and tanks and guns that Congress has been spending our money for?

A big job remains to be done in educating people not to expect too much too soon. And it wouldn't hurt to start some of the education with the daily press, which is relatively unfamiliar with industrial processes. *The New York Post* is a case in point.

Burnham Finney

GAGING BUSINESS

Canadian munitions makers buy machine tools. Plane builders and Chrysler are important purchasers. 900 planes to be produced in August. British to place big orders in this country

Problems of plant expansion and of retooling for production of munitions and related items for national defense continue to absorb the attention of the metal working industry Operations and payrolls are at a high level and will rise further in the fall The most active winter since world war days lies ahead for manufacturers Potential shortages of skilled help are among the chief worries

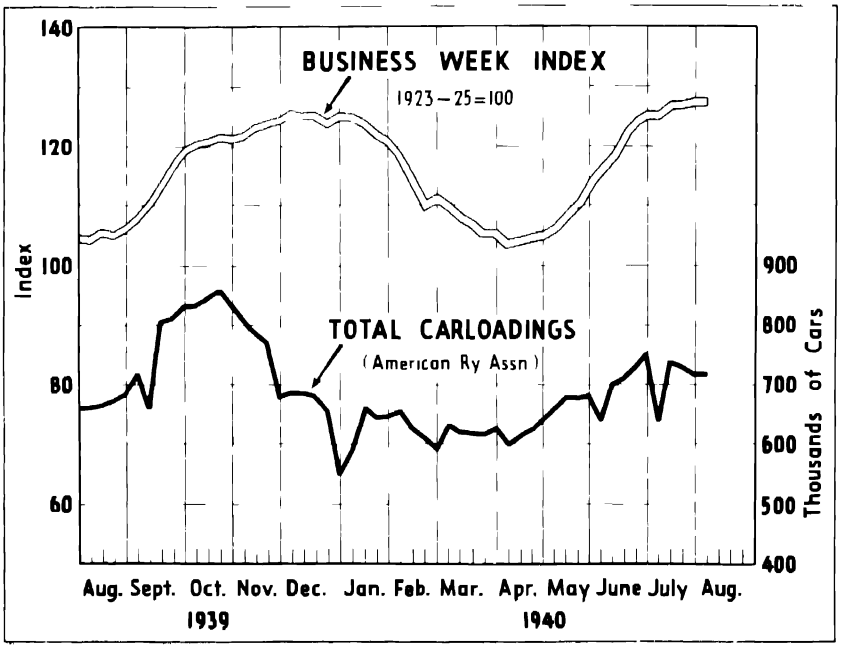
Machine Tools—Large quantities of machine tools have been purchased the past two weeks, but not so much has come from Britain Canadian munitions makers bought heavily U S aviation companies, particularly engine builders, have placed large orders Government arsenals and navy yards too have been important buyers Chrysler getting ready to fabricate tanks on a mass scale already has contracted for sizable numbers of machine tools A variety of industries, including automobiles refrigerators and tractors, have been in the market for new equipment The volume of inquiries likely to appear in the next 60 days is almost unprecedented One government plant alone will need $30,000,000 of machine tools, and that is only one of many Production recently dropped slightly because many machine tool plants shut down for annual vacations, but it has been maintained straight through the summer at more than 100 per cent of what the industry's capacity was last September Since that time plant facilities have been enlarged almost 30 per cent Fewer delays are now encountered in securing export licenses promptly than when expert control was first established in July

Railroad Equipment Around 4,700 freight cars have been bought since August 1 Atlantic Coast Line has ordered 615 cars from Pullman, 800 from Bethlehem and 150 from Mount Vernon Car Southern Pacific has contracted for 500 cars each from General American Transportation, Pressed Steel Car, Bethlehem and Mount Vernon Car and 350 from American Car & Foundry Louisville & Nashville will take 100 cars from Pullman Orders have been placed recently for 30 steam and 18 diesel electric locomotives The Rock Island is asking bids on trust certificates for 1 100 freight cars which it wishes to buy

Steel Barring an early peace steel production in the fourth quarter is likely to run 90 per cent or higher Output is at that level now Export demand, particularly to Great Britain, accounts for more than 15 per cent of current sales Recently considerable steel is believed to have been bought for inventory Electric furnaces are now being installed to take care of any possible shortage in alloy melting capacity

Aircraft About 900 planes, half of which will be trainers, will be turned out in the United States this month By the year end the monthly total will be 1 500 The British have been informed that production of combat planes, exclusive of trainers, will rise to 1,300 a month by late 1941 Expansion of Douglas' plants in California, at cost of $20,000,000, is the forerunner of other gigantic increases in the industry's plant capacity Wright will farm out a large amount of parts work at its projected Cincinnati engine factory Pratt & Whitney is reported contemplating further plant additions at East Hartford Allison is now purchasing new equipment supposedly for expansion of its engine building capacity North American Aviation has received an order from the War Department for 700 training planes costing $11,335,651

Munitions Projects are slowly getting out of the talk stage Within the next week 15 to 20 out of the Army's 67 munitions plants to be financed by the government will be awarded, all of them to be located inland Chrysler will make about 1,000 tanks of 25 ton rating under a $54,500 000 award for plant and equipment made by the War Department The government will own the plant which will be built by Chrysler $20,000,000 will go for plant equipment The British are negotiating for 4 000 tanks in this country If the war continues through the winter, it is believed the British will place war orders here which will rival or exceed in size the U S Government's program British purchases from now on will be standardized to conform to regular equipment of the U S Army and Navy A naval gun factory as large as the one now in Washington is being planned General Electric has an order for $4,671 000 of anti aircraft equipment



WILL BUILD 30 GOVERNMENT ORDNANCE PLANTS

$300,000,000 will be set aside for this defense project in the pending five billion dollar military appropriation. The plants will be privately operated and built to specifications

By ROBERT COLBORN

WASHINGTON—Thirty government-owned ordnance plants will be built with money—about $300,000,000—to be provided in the pending five billion dollar military appropriation. They will be operated under contract by private firms and built to the specifications of the operating firm; this is the same procedure followed on the Indiana powder plant du Pont has contracted for. Locations of most have not yet been determined and in any case are a deep secret. It is known however that they will be placed west of the mountains, mostly east of the Mississippi, and at least 200 miles north of the Mexican border, an effort will be made to stay 200 miles south of Canada, but this will not be possible in all cases.

The area within these boundaries is split up into five "ordnance areas" among which the plants will be distributed. Intention is that plants will be so located that, together with existing munitions plants, they will provide a complete munitions-production set-up in each district, if one district is captured or bombed, it will not interfere with production in the others. Area A includes northern Indiana and Illinois, southern Wisconsin and Minnesota, and all of Iowa. Area B includes Ohio, the southwestern part of Pennsylvania, West Virginia and Western Virginia, and eastern Kentucky. Area C includes southern Indiana and Illinois, western Kentucky, Missouri, and eastern Kansas. Area D includes western North Carolina, northern Georgia and Alabama, and eastern Tennessee. Area E includes western Tennessee, Arkansas, Oklahoma, and the northern part of Mississippi, Louisiana and Texas.

$20,000,000 Powder Plants

Biggest of the new factories will be two $20,000,000 smokeless powder plants and a $20,000,000 ammonium-nitrate plant for extraction of atmospheric nitrogen. Supplying the latter, will be a $15,000,000 ammonium plant. Seven shell-loading plants will average $10,000,000 apiece, as will a small arms ammunition plant. Eight plants for manufacture of various explosives will cost a total of $53,500,000. A cotton purification plant will cost $6,000,000, and three plants for fuse and bag loading will total $15,500,000. Seven metal-working plants are contemplated: four $6,000,000 shell-forging plants, two $7,000,000 aircraft cannon factories, and a $12,000,000 machine gun factory.

A further $465,000,000 will be needed later, but it is not believed that it can be put under way this year, so no appropriation has been asked.

Slow Progress Is Being Made

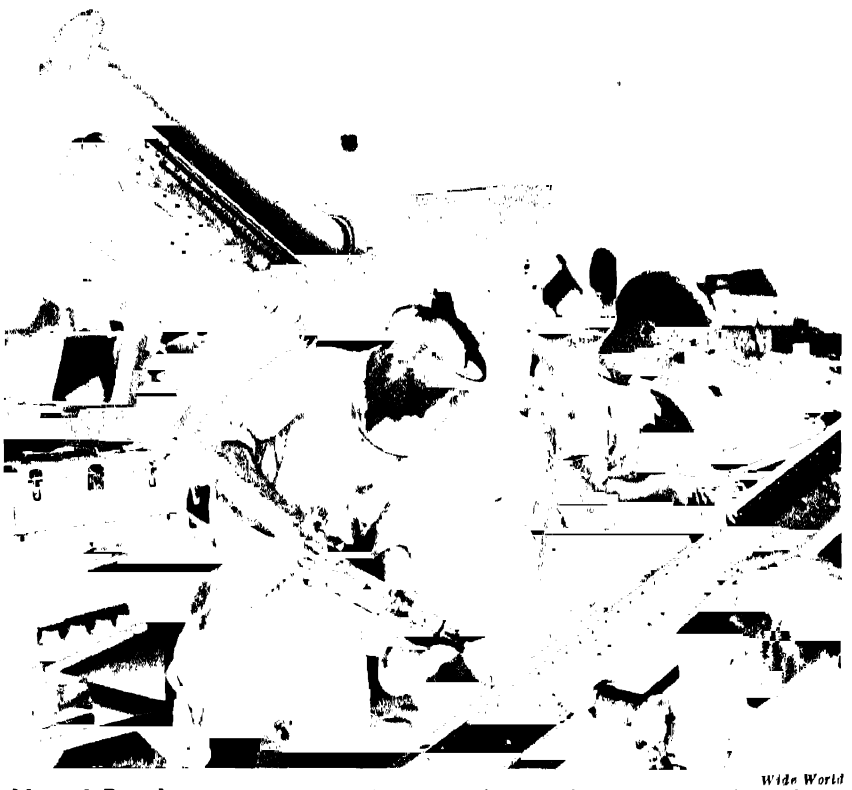
Fairly slow progress is being made in utilization of the $200,000,000 already appropriated under the same head of "expediting production." About $13,000,000 has been allocated to improvement of existing arsenals. It has been decided to use $520,000 for an anti-aircraft searchlight plant, but no contract has been approved. Negotiations are underway with the Hercules Co. for a $15,000,000 smokeless powder plant. In addition $95,000,000 has been tentatively allocated to aircraft plants and turned over to the defense commission, but it is not planned to build any aircraft plants during the immediate future.

The shell-forging plants, to be provided with the new money, will be simple factories for forging and machining shells. They will be expected to turn out enough shells to supply an army of 2,000,000 men. They will be located in the steel areas, Birmingham, Pittsburgh, and Chicago.

Plants Will Make Airplane Cannon

The cannon plants will manufacture 20-mm and 37-mm cannon for installation on airplanes, one of the new developments that has come out of the war. Probably General Motors will operate one of the plants and Chrysler the other; they will be located in the Middle West. In addition Bendix is building a few cannon, and it will probably be necessary to install some government machinery. Chrysler expects to build a few cannon in its existing plants, despite the fact that it will undertake a huge order for tanks.

Plans for the $12,000,000 machine gun plant are now being worked out with a manufacturer. It is intended to use some of his existing buildings, so most of the money will go for tools and fixtures, so as to strive for optimum output with the lowest average cost.



Wide World

Almost Ready—*U. S. tank and gun production is being rushed in plants and arsenals throughout the country. At the Rock Island Arsenal the carriage of a 155mm Howitzer is receiving the finishing touches with a motor driven buffer. At right men scrape to secure a smooth finish*

May Tax "Excess Profits" 25 to 40 Percent If Present Amortization Bill is Passed

WASHINGTON—The tax-amortization legislation has a long way to go before it reaches the President's desk, and some changes in the original draft are already being discussed, but chances are that the broad outlines will be retained. Briefly the bill would permit amortization of plant, for tax purposes, over a five-year period, and would tax "excess profits" at a rate ranging from 25 to 40%.

The rapid amortization would apply both in computing the excess profits tax and ordinary income tax. The period of amortization may be shorter: If the emergency is terminated by the President in less than five years the amortization may be re-figured retroactively over the shorter term. Similarly, if the Secretary of War or Navy certifies that a particular facility is no longer useful for munitions production, it may be amortized over the period during which it was useful. These procedures now apply to "lands, buildings, machinery or equipment" installed after July 10 of this year. The administration is supporting a change to make the date Jan. 1, 1940.

To be eligible for rapid amortization, facilities must be certified by the Defense Commission as well as by the Army or Navy.

There is a possibility that some strings may be put on rapidly-amortized facilities. Army and Navy are believed to favor a plan by which facilities would have to be maintained in shape to produce munitions, on a standby basis, after being written off. This is opposed by the Defense Commission.

The subcommittee preparing the bill recommended that if defense orders cease before the manufacturing facilities are paid for, the government reimburse the manufacturer for the difference and that such payments be exempt from taxation.

The bill repeals the Vinson-Tramel limit on profits of ship and plane manufacturers and substitutes an excess-profits tax applying to all corporations (except personal service corporations), defense or otherwise. The first $5,000 of excess profit is tax-free. Thereafter a tax must be paid varying from 25 to 40% depending on the ratio which excess profits bear to normal profits.

Amount of excess-profit may be computed, at the taxpayers choice, in two ways. It may be obtained by subtracting from net income in the taxable year the average income during a base period 1936-39, with a technical adjustment for changes in capitalization.

Alternatively, the taxpayer may deduct from his net income an amount equal to what his income would be if he had earned, on his present invested capital, the same rate as he earned on his capital during the base period. This rate could not be more than 10% or less than 4% (6% on the first $500,000 of capital). Invested capital is defined as equity capital plus a percentage of borrowed capital (roughly, all of the first $100,000, two-thirds of the first $1,000,000, and a third of the rest.)

Corporations not in existence during part or all of the base period would use the capitalization method and assume, for the missing years, present capitalization and earnings of 10% on the first $500,000 of capital and 8% on the rest.

In general, corporations which earned less than 4% during the base period would use the invested capital computation. Those earning more than 10% would use the income computation. For the in-between cases the results would be about the same.

NO COMMANDEERING OF PLANTS

WASHINGTON—Industry won a skirmish in its battle with the Administration over amortization and other concessions on defense contracts when the House repealed the power granted the Secretary of the Navy to commandeer plants for munitions manufacture. This authority was the Administration's ace in the hole in event of an impasse over contract conditions; it had been planned to seek similar authority for the War Department. The repealer was tacked onto the $5,000,000,000 defense appropriation, on which the Senate has yet to act. The President can still force manufacturers to take orders under the Defense Act of 1916, but in doing so he makes the implicit announcement that war is "imminent."

Exports of Machinery During June, 1940

	June 1940	March 1940	June 1939
Electrical Machinery and Apparatus	$9,607,069	$10,335,418	$8,717,087
Power generating machinery except automotive and electrical	2,126,581	2,119,230	1,161,760
Construction and conveying machinery	3,115,301	3,223,837	2,558,330
Mining, well and pumping machinery	3,788,489	5,245,434	5,804,925
Power driven, metal-working machinery	18,564,300	18,267,473	6,660,447
Other metal-working machinery	596,917	922,889	403,905
Textile machinery	1,093,851	1,233,464	798,865

Metal-Working Machinery

Engine lathes	$1,530,297	$1,290,669	$379,883
Turret lathes	1,451,624	1,432,524	432,869
Other lathes	888,025	643,324	335,465
Vertical boring mills and chucking machines	809,490	797,520	177,625
Thread cutting and automatic screw machines	1,120,424	1,761,598	474,003
Knee and column type milling machines	367,055	740,759	399,730
Other milling machines	1,438,827	1,185,203	627,126
Gear cutting machines	708,420	735,039	268,595
Vertical drilling machines	261,353	229,164	121,621
Radial drilling machines	200,808	289,428	75,035
Other drilling machines	714,837	350,760	34,235
Planers and shapers	338,424	473,904	151,203
Surface grinding machines	298,060	550,668	193,667
External cylindrical grinding machines	437,110	379,553	214,493
Internal grinding machines	562,980	920,403	232,900
Tool grinding, cutter grinding, and universal grinding machines	306,839	856,532	323,551
Other metal grinding machines and parts	748,398	845,701	291,525
Sheet and plate metal-working machines and parts	714,319	543,580	238,647
Forging machinery and parts	763,117	805,763	394,220
Rolling mill machinery and parts	2,884,832	1,414,317	387,114
Molding machines	23,690	45,377	15,276
Other foundry equipment and parts	176,041	110,336	46,835
Other power-driven metal-working machinery and parts	1,723,787	1,765,351	838,610
Pneumatic portable tools	73,285	466,856	111,469
Other portable and hand or foot-operated metal-working machines and parts	174,436	150,283	132,120
Chucks for machine tools	56,508	38,717	19,486
Milling cutters, machine-operated threading dies, and taps and similar machine operated metal cutting tools	106,640	88,336	72,355
Other metal-working machine tools and parts	186,039	158,697	68,475

U. S. Army Spends $43,859,180 For Specially Equipped Trucks

DETROIT—Army orders for trucks are being released in rising volume. A total of $43,859,180 has been awarded recently to many companies. Fargo Motor Corp. has received a $10,518,435 order for 13,556 half-ton trucks, 881 specially equipped sedans. All have a four-wheel drive and are being built to special Army requirements. These will be the first Army trucks designed for visibility during blackouts, and for operation over rough terrain day or night. Chevrolet has been awarded an $8,473,989 contract for 1½-ton trucks while Yellow Truck has received $15,254,786 for heavier trucks.

Plants May Lose 1 Out of Every 5 Young Men If Draft Bill Passes in Its Present Form

WASHINGTON—If the draft bill passes in its present form, about one in five of the unattached healthy youngsters in your plant will be called up for training within the next six months unless you can show that their jobs are "necessary to the maintenance of the national health, safety, or interest." When they finish a year's training you will have to give them their jobs back under penalty either of being up before the NLRB or of a suit in federal court—the point hasn't been decided yet. Employees must ask for the return of their jobs within 40 days after honorable discharge.

Everyone between 21 and 31—about 12,000,000 men—must register. It is estimated that about 4,000,000 names will remain after elimination of those with dependents, the physically unfit, and those with essential jobs. From this group, 400,000 will be called up during the quarter beginning Oct. 1 and another 400,000 starting in April. The following October about 600,000 will be called (to make up for dismissal of the National Guard).

Men called up will be permitted to defer rent, insurance premiums, taxes and installment payments falling due during the training period or war service.

No blanket exemptions for particular types of worker will be granted. Decision will be made on each individual case, based on a questionnaire and personal interview. The job of deciding is done by local draft boards appointed by the governors. For their guidance, the boards will have a list of industries and skills where defense shortages are expected and will check with local firms as to government contracts held.

Similar rules apply to the National Guard and reserves. All the guardsmen and about half the 100,000 reserve officers will be called up. However, guardsmen with dependents are now being released, and industrial exemptions will be made when the time comes.

Senate Committee Holds Hearings On Amendments to Wagner Act

WASHINGTON—Senate Labor Committee is holding hearings again on the amendments to the Wagner Act, which were passed by the House. Politicos here say this is a stall: the hearings are put on only because the session was strung out by the defense program, and there was no further excuse for the pigeon hole. Labor is screaming that defense equipment makers are threatening its gains under the New Deal. Industry hollers back that labor is putting on the squeeze in an emergency. Both sides are turning the heat on the Senate. Although the experts don't expect any action this session on the Wagner amendments, this is the last session of the 76th Congress. If the Senate doesn't act, the bill passed by the House will automatically wash off the slate, which must be clean for the 77th Congress. Some observers indicate that amicable relations between labor and business may not come until too late.

Index of Articles on Defense Published by American Machinist

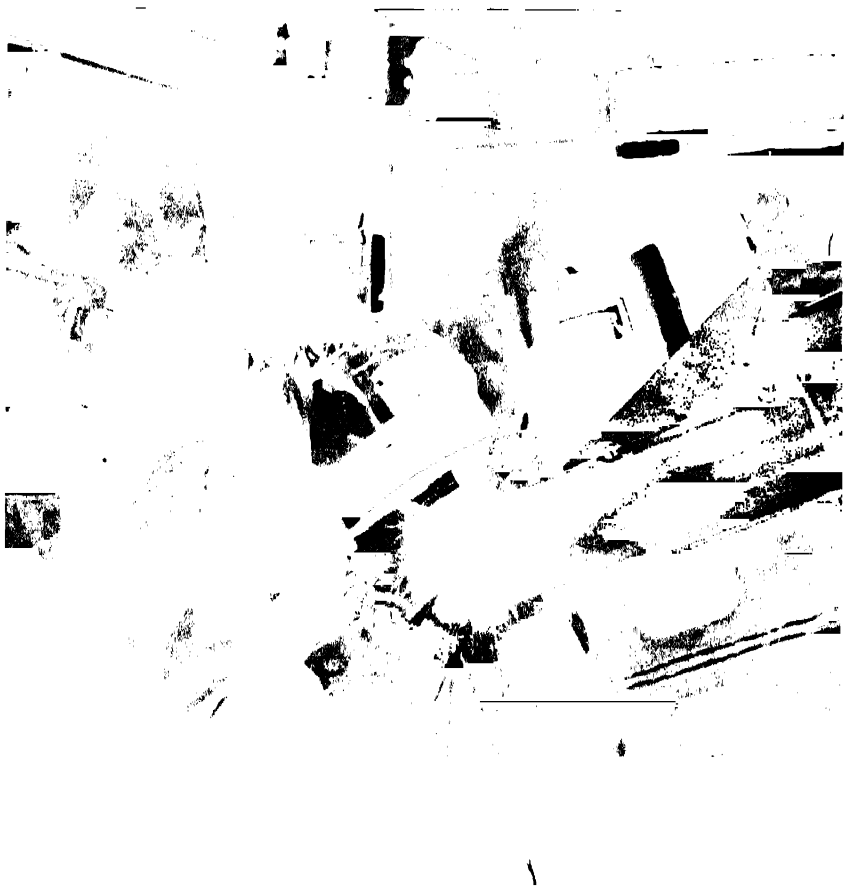
An index of articles on National Defense problems and munitions production which have appeared in American Machinist in the past year and a half has just been completed. Mimeographed copies of the index are available to readers on request. They are free of charge.

Split Bids and F.O.B. Factory Acceptable to Defense Commission

WASHINGTON—In order to hasten the delivery of equipment and at the same time to spread contracts over the country, the National Defense Commission has adopted two new policies: acceptance of bids F.O.B. factory (instead of army depot), which nullifies any disadvantage a bidder might have through the geographical remoteness of his factory; and acceptance of split bids for portions of large orders, which enables many small manufacturers to participate in orders which would otherwise go to large manufacturers.

Some observers indicate this to be a victory for mid-west senators who called on the Defense Commission for greater consideration to manufacturers in the region between the Rockies and the Appalachians.

In cases where the government is furnishing the material bidders will be informed that, under the new policies, such material will be delivered to the plant without any expense to the contractor. In split bids the invitations will advise the bidders of the maximum and minimum quantities which may be awarded.



Welding The U.S. Defense—*At Rock Island Arsenal, Ill. welders are being initiated into the intricacies of producing artillery material by modern methods. Stringent instruction is given to the students as the above picture, released by the Ordnance Department, U.S. Army, indicates*

Despite Lack of Labor Disputes, Trouble May be Ahead as Defense Plans Are Rushed

As the defense program creeps toward full tide, expanded plant and increased production have effected a substantial reemployment, subtly transforming an important part of the labor market from a buyer's market to a seller's First fruits of the change has been the growing restiveness of organized labor which finds its bargaining position enhanced In other times, comparable movements of the industrial index have been the signal for an epidemic of strikes as unions moved to secure for these members a measure of the prosperity which better business promised for their employers One of the most interesting phenomena of the current boom period has been the comparative dearth of labor disputes which have led to work stoppages

Two things, one psychological and one logical, may explain it The psychological influence is accountable to the temper of the times A labor leader does a lot of thinking these days before he calls a strike With a defense-minded country convinced that increased production is the number one item on our agenda for preparedness, he will hesitate a long time before risking the loss of one of the most decisive elements in any labor dispute. public sympathy. Unless a union chief can make out a waterproof case for striking, he knows that such action will have public opinion solidly against him

Hillman's Work Cited

The other factor which explains the peaceful summer on the labor front is the work of the Labor Division of the National Defense Advisory Commission Under the direction of Sidney Hillman, the Labor Division has moved immediately into every potential trouble zone where a dispute threatened to embarrass defense production. Urging conciliation, mediation, or arbitration, pleading for time, for reasonableness, for compromise; appealing to patriotism and unselfishness, Hillman and his aides have done an unprecedented job of strike prevention

Some of the fevered spots which responded to the Hillman treatment and are now doing nicely are, (1) General Motors, where a deadlock in contract negotiations threatened a serious strike—Hillman's intervention affected a compromise, got a contract agreed on, and led to the establishment of a grievance handling plan which now functions about as smoothly as any in the country. (2) Federal Shipbuilding, where an unauthorized, wildcat strike was about to put a brake on naval building—Hillman got the men back to work on an arrangement in which the company promised to grant immediate pay boosts, consider further advances, Federal now operates at capacity (3) Aluminum Company of America, where, citing the company's profits for 1939, the CIO demanded a 10c an hour wage increase, and the company refused to raise rates, contending that it would put Alcoa wages out of line with wages which prevailed in the communities where Alcoa had plants—Hillman stepped in, and with arguments which occasionally lasted eighteen hours at a stretch, prevailed on the union and the company to agree on a 2c an hour increase in pay

Trouble Still Ahead

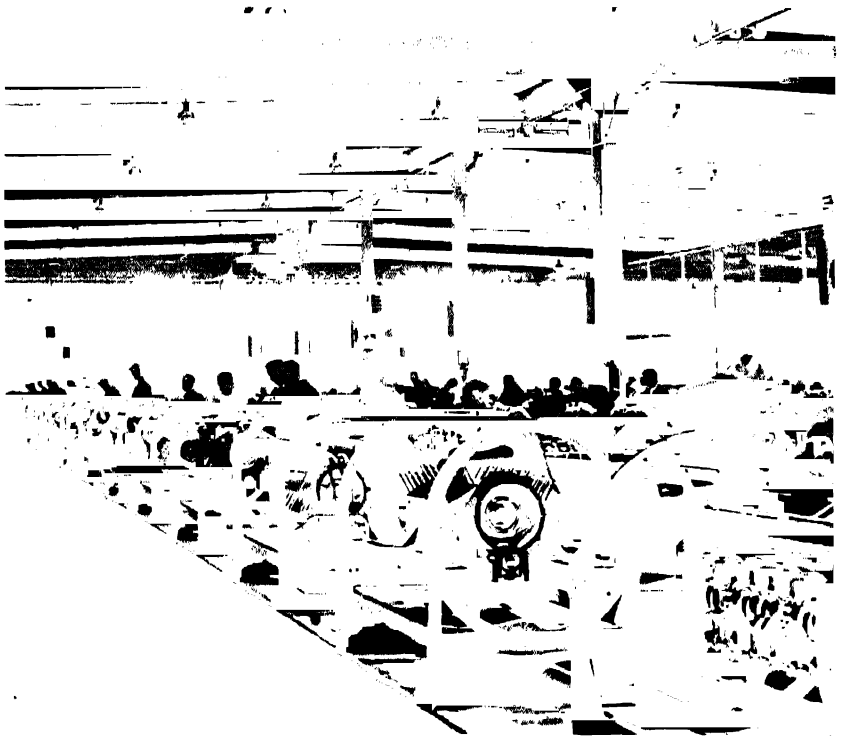
But pluperfect as the record is, the Defense Council peacemakers are not out of the woods Coming up are new hotspots which will challenge the ingenuity and the tenacity of the Hillman technique Trouble for the aircraft industry is in sight as the CIO auto workers announce a whirlwind campaign to organize that largely unorganized industry It is open gossip in Washington that the Administration would like to see aircraft organized The suggestion is that a system of institutionalized collective bargaining in the industry will keep both labor and management responsible and provide the machinery necessary to keep grievances from inhibiting production

Another industry likely to have trouble is shipbuilding Bethlehem, Todd, and others are either currently involved in labor trouble or sit uneasily on hot seats Before the snow flies, Hillman may have his hands full of shipyard problems

The only fly in Hillman's salve is John L Lewis, who as CIO head is technically Hillman's superior in the labor movement Lewis has already charged Hillman with favoring the rival AFL and hints darkly that the Defense Commissioner is playing the employer-Roosevelt game

NEW EXPORT REGULATIONS EXPECTED

WASHINGTON — Supplemental rules and regulations for the export of machine tools are expected to be issued this week by the office of the Administrator of Export Control They will include a revision of the questions which machine tool builders must answer when they make applications for export licenses It is planned to ask more specific questions about the machines to be exported The Administrator of Export Control states that delays have occurred in granting licenses because information supplied has in many cases been inadequate



Germany's Power *-Tens of thousands of Junkers Jumo 211 aircraft engines have been produced to power Germany's "Stukka" dive-bombers and other war planes. In one of the Junkers factories (above) these 1,200 horse-power inverted V-type gasoline engines are finally assembled en masse*

WATCHING WASHINGTON

Shortage of skilled labor causes no delay in defense program. No penalty clauses in defense contracts; government will try to simplify specifications; Army stands pat on Garand rifle.

BY BLAINE STUBBLEFIELD

WASHINGTON– Despite all the talk about shortage of skills in defense production, no instance of delay for that cause has yet come to light This conclusion is confirmed by Dr Isador Lubin, Commissioner of Labor Statistics, who is now serving on the Hillman labor supply staff of the Defense Commission and by Sidney Hillman

Measures being taken by the Government and by employers to provide against skill shortage are almost entirely in anticipation of future short supply It is true of course that the arsenals, the Navy yards and private employers manufacturing defense equipment are not getting the kind of men they want But the *ideal* man is never hired by anybody

It is true also that long lines of men are waiting outside personnel windows and few of them are hired But the reason is that few of them have the training wanted The Glenn Martin Company is a case in point Martin is getting enough men but the company must interview a tremendous number

The government's most recent step to provide skills for the anticipated shortage in defense production is the Defense Industries Employment Register, set up by WPA The Register is examining the work records of 2,500,000 persons on or awaiting assignment to WPA rolls This analysis will show the workers' skills or aptitudes in which they can be given training under the vast Hillman training program of the Office of Education and the Defense Commission In addition to voluntary statements of the 2,500,000 workers, WPA has performance records of about 1,700,000 workers employed

Further steps to increase defense production by adding men and increasing shifts have been taken by both Army and Navy, in cooperation with the Hillman office The War Department ordered all six arsenals on a three shift basis August 10 Laborers and mechanics are paid time-and-a-half for over 40 hours per week

Meanwhile the Navy, on August 8, authorized all stations and yards to work employees in excess of 40 hours with overtime pay as permitted by law But, meanwhile, Secretary Knox directed that the working force be increased to permit expansion of shifts and reduction of overtime He asked that no employee be worked more than 48 hours a week unless necessary The Secretary contending that in certain localities skill shortages exist in special occupations urged all naval contractors to foresee labor requirements and to inform State and Federal employment agencies of their needs so as to avoid delay and to minimize migration He urged also that "pirating" be diminished He said that present shortages are due to failure of industry to maintain apprentice programs during the lean years after 1929

No Penalty Clauses

Penalty clauses are not going to be included in defense manufacturing contracts The priorities division set up in the Army and Navy Munitions Board wants to be free to juggle delivery date when it seems desirable without having to argue over financial penalties Outstanding government contracts with a penalty on the delivery date will be modified when they have to be pushed aside in favor of a "preference contract" This matter is being handled by the defense commission, and manufacturers who get into a tangle should go there for help

MAY SIMPLIFY SPECIFICATIONS

The defense emergency may reduce the multitude of government specifications that have grown up in different agencies for the same thing James Lynah on the staff of Procurement Coordinator Donald Nelson, has been assigned the job of coordinating standardization studies now being made by different agencies So far he is still finding out what effect on production the variations in specifications have Later the worst cases will be straightened out There is slight prospect of any general revision of federal specifications, but some simplification may result Also being considered is an agreement by which all procurement agencies would accept ASTM standards as alternatives to their own

Score on the Garand

Army officially is still standing pat on its own design for a semi-automatic rifle, the Garand But opinion is still divided even within the department The Marine Corps in particular are not at all sold on it Although they are allotted 13 000 Garands under the pending $5,000 000 - 000 bill they still think maybe they'd rather have 1903 Springfields on which production has been stopped Moreover the marines are interested in an experimental semi-automatic that Winchester has worked up The Corps thinks the Winchester will cost about half as much as the Garand and can be turned out faster Secret tests of the Winchester were made this month, but Ordnance is keeping completely quiet about the results Meanwhile Army denies the reputed faults of the Garand overheating and muzzle droop and points out that even if some other rifle might be better the Garand is in production and it would take time and create confusion to switch over

Plan Great Lakes Sub Making

Navy is busy discussing with every shipyard in the country including those now out of commission the part they can play in the pending fleet expansion Actual contracts are waiting until Congress completes action on the $5 000,000 000 appropriation, but preliminary problems are being thrashed out Nearly the only yards in commission that are not now chock-a-block are those in the Great Lakes, and these will probably be drawn extensively into naval work for the first time since the war Typical of the problems involved is how to get submarines, in which some yards are interested to the ocean The St Lawrence locks are too small, but a plan is being worked out by which the subs would go down the Illinois River partially submerged to get under bridges as far as Lockport There they would be put on a floating drydock with shallow enough draft to negotiate the Illinois and upper Mississippi, and down the lower river under their own power

No Turtle-Back Battleships—Yet

Turtle-back battleship plans proposed a few months ago as an answer to aerial bombardment have boiled down to a program of substituting guns capable of both surface and anti-aircraft fire for some now only usable against surface craft and increasing the protective screening around some of the deck guns

Foreign Owners of Machine Tools in U. S. Ports Will be Paid Off by the Government

WASHINGTON—The problem of how to recover title to machine tools suitable for defense needs but held legally at U. S. ports by foreign governments, such as Japan, is about to be solved. A bill, certain of passage, has been introduced in Congress giving the President power to requisition such tools the exportation of which has been denied.

The bill provides that the government shall pay the owner a sum which "the President shall determine to be fair and just." If the owner is unwilling to accept the sum fixed, he shall be paid 50 per cent of it and shall have the privilege of suing the Federal government for whatever amount he thinks is still due. Authority to run until June 30, 1942.

It is reported that necessity for legislation arose as a result of the reluctance of Japan to surrender to the U. S. Army and Navy many machine tools in her possession in this country for which export licenses could not be procured. These machine tools had been completed by the builders and paid for, so that they were the property of the Japanese government. Many of them are at shipside and are of the type needed at present on defense projects.

Considerable ill feeling was caused recently when U. S. Navy officials are said to have gone into the holds of ships at U. S. docks and removed machine tools owned by and destined for Japan. This incident resulted in a vigorous protest by the Japanese ambassador. Since then it has become necessary to secure licenses at the State Department for export of machine tools.

With Increased Plant Expansion, Canada Sees Its Labor Shortage Becoming Acute

MONTREAL—New plant construction in Canada for military purposes is now assuming major proportions. To the $120,000,000 of new plant construction that was completed or under way the first of this month, has been added contracts for $10,000,000 while another $40,000,000 worth of new plant projects are planned by the government to begin shortly.

Most of the new construction commitments are very recent—since the capitulation of France. During the first part of this year plant expansion projects amounted to only $30,000,000. However, by the end of June the valuation of new plant construction for war purposes amounted to $110,000,000.

A great deal of the new building projects will provide facilities for the manufacture of munitions, guns, war machines, etc. The scope of the planned expansion indicates that Canada has made speedy industrial progress since relatively few of these products were made in Canada during the last war.

Despite the commendable progress Canadian industry faces a labor shortage which is becoming increasingly acute. Although a population increase occurred since 1929, the labor "reserve" is not more than 10 percent at present. Government financed training schools, operated by provincial governments this summer, will be able to provide several thousand young men for airplane and a few other war plants. However, many more workers will have to be supplied. Some observers indicate that an increased amount of "stealing" trained workers is being done by plants hard pressed to maintain production schedules. An enforced registration of all Canadian manpower, to begin this month, may provide some means to help meet this problem.

Meanwhile in aircraft production 360 airplanes per month are scheduled by the spring of 1941, and a progressively increasing rate is planned thereafter. However, there are no definite plans for motor manufacturing in Canada. For these supplies the government looks to the U.S.

The following companies have been awarded government defense contracts in the past few weeks: MacDonald Bros., Ottawa, $21,485 aircraft; Fleet Aircraft, Ltd., $23,222; Jacobs Aircraft Engine, Pottstown, Pa., $7,941,120; Aviation Electric Ltd., Montreal, $199,214; Weaver Industries, Ltd., Chatham, Ont., $34,881.

U. S. Government Contracts Awarded to Metal-Working Firms

(Defense contracts on page 636J)

Contractor	Gov't Agency	Commodity	Amount
Scovill Mfg. Co., Waterbury, Conn	Ordnance	Cartridge cases	$115,744
Fairbanks, Morse & Co., Chicago, Ill	Navy	Propelling machinery	4,286,811
Ingersoll-Rand Co., New York, N. Y.	Navy	Pneumatic tools	36,877
Westinghouse Electric & Mfg. Co., Washington, D. C.	Navy	Arc welding machines	32,780
The Baldwin Locomotive Works, Philadelphia, Pa.	Interior	Locomotive	85,700
Steuart Motor Co., Washington, D. C.	Procurement	Trucks	36,183
International Harvester Co., Washington, D. C.	Procurement	Trucks	23,008
Spartan Aircraft Co., Tulsa, Okla	Navy	Airplanes	1,859,880
United Aircraft Corp., Propeller Div., East Hartford, Conn.	Navy	Equipment, propeller overhaul	25,083
Sperry Gyroscope Co., Inc., Brooklyn, N. Y.	Ordnance	Directors	2,422,118
Budd Wheel Co., Detroit, Mich.	War	Shells	1,243,051
Norwalk Lock Co., New York, N. Y.	War	Shot	125,998
Aetna-Standard Engineering Co., Youngstown, Ohio	War	Gun Carriages	3,302,139
Koppers Co. (Bartlett Hayward Div.), Baltimore, Md.	War	Gun Carriages	3,725,930
Kilby Steel Co., Anniston, Ala.	War	Forgings for Shell	113,228
Line Material Co., Milwaukee, Wisc.	War	Shell	104,432

PLANE MAKERS AGREE TO PRODUCE WITHOUT AMORTIZATION GUARANTEE

WASHINGTON—Agreement by all the major plane manufacturers to go ahead, at least partially, on the airplane production program without waiting for action on amortization breaks up a blockade so tight that in seven weeks contracts had been let for only 33 airplanes. Coming two weeks after a hot conference with military and defense commission officials, the present agreement is understood to cover only that part of the program which can be undertaken without actual expansion of plant. The manufacturers are proceeding on the basis of semi-formal assurances that if they don't get firm contracts before a certain date they will be reimbursed for out of pocket costs for tools and dies. The plans cover about 4,000 of the 8,000 planes for which appropriations have been made (19,000 more are in pending appropriations).

There are some exceptions to this hesitant procedure. North American has for some weeks been building and storing trainers, without any definite order. And Douglas, which has been a leader of the group in the industry which wants to play ball with the administration, this week announced plans to start immediately a $20,000,000 plant expansion.

Meanwhile, Knudsen, in effect, has informed the British that by late 1941 U. S. production of actual combat planes, exclusive of trainers, will exceed 1,300-1,400 a month. Production this month, including about 50% trainers, is 900 a month and will reach 1,500 by year-end.

INSIDE DETROIT

Automotive industry plans to increase production for the 1941 model year. Year just closed saw a 23 percent gain in output; optimistic dealer surveys see public's buying power continued

BY RUPERT LE GRAND DETROIT EDITOR

DETROIT—Buoyed up by a 23 per cent gain in output for the production season just closed by near-record summer sales and by optimistic dealer surveys of the public's continued buying power the automobile industry is laying plans to swing into far heavier initial production than was the case a year ago. Production plans for August and September are still somewhat embryonic because production chiefs can not say exactly at this stage just how many cars will be produced in a given week or month. But every effort is being made to conserve the time gained by relatively short changeover periods and to reach peak output within a few weeks.

In view of recent attempts by automobile companies to stabilize employment throughout the entire production season the plans of Pontiac are significant pointing as they do toward expectations of an unusually good fall. H. J. Klingler president and general manager reports that 10,000 new models will be built in August and 22,000 in September a gain of over 100 per cent as compared with the same two months in 1939. Pontiac expects a 30 per cent sales increase for 1941 although it built 217,000 cars for an all-time record in the year just ended.

Buick as reported earlier has expanded its plant for a total annual capacity of 350,000 cars whereas it enjoyed an all-time sales high of 282,000 cars during the 1940 season.

Near Capacity Output

Hudson and Packard are nearing capacity output of 1941 models. Studebaker is not quite as well advanced but should have dealers well stocked by the first of September. Willys will show its new cars to newspaper men on August 16 but two or three weeks will pass before public showings. Nash is probably the latest of the independents and will not commence assemblies until late August.

Nash has confirmed reports made several months ago that a new car will be offered in the Chevrolet, Ford and Plymouth price class. Company officials stress the fact that a full-size automobile will be offered not a scaled-down model. The body shell will be the same as used in the Ambassador six and eight and both of these senior models will feature greater width than provided in the 1940 models. Power plant wheelbase and fittings will distinguish the three lines.

Thus Nash hopes that the new car will have the same effect on its fortunes as Studebaker has enjoyed with the Champion. In addition to low price maximum body size and an expected wheelbase of 112 in. the junior model will be engined for performance with economy. It is said that preliminary tests have shown a gasoline economy of 30 miles or more to the gallon. For some time Nash toyed with the idea of naming the new car 'American' but that idea has been dropped in favor of calling it a Nash with a certain series designation.

Buick Will Build 300,000 Cars

Buick plans to build a minimum of 300,000 cars in 1941 at an expenditure of more than $200,000,000 for materials and supplies alone.

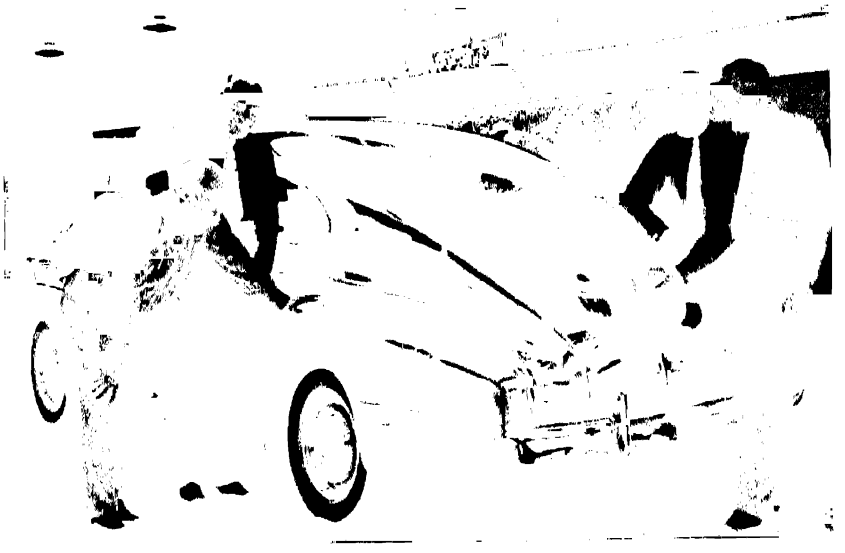
A larger share of the national income is finding its way into the purchase of automobiles. Coincident with Mr. Curtice's outlook for the remainder of this year the production of 16,000 cars is planned for August and a total of 130,000 is scheduled for the balance of the year. This figure is 20,000 more than last year and is the heaviest manufacturing program ever launched by Buick.

In addition to the $10,000,000 spent for retooling and plant expansion Buick has committed itself for $100,000,000 worth of material and supplies for the balance of this year. During the entire model year this division will spend over $200,000,000 for the materials and supplies exclusive of payrolls.

In September Buick will reveal that a new radical tear-drop model with a torpedo width body has replaced the old style special series. Engine outputs have been increased by compound carburetion improved combustion chamber design and higher compression ratios.

PRIORITIES MAY HURT AUTO MAKERS

DETROIT - The automotive industry is particularly interested to avoid priorities for machine tools steel and other commodities. Although leaders in the industry are talking in terms of a four million car year for the 1941 model whether the realization comes may depend upon how much the defense program interfers with the production plans. Due to the increased employment and purchasing power, the market exists for an increased supply of automobiles and makers insist that production should not be curtailed because passenger cars as such are not essential to the defense program.



Here They Come —*Half concealing half revealing Messrs. O. H. Young, W. J. Jefstader, C. J. Chayne and Harlow H. Curtice tantalizingly present a good look at the Buick Special for 1941. The tear drop body contour introduced represents a radical change in body types.*

U. S. Tank Production Expands as Army Organizes More Armored Motor Divisions

WASHINGTON—No one has yet suggested 50 000 tanks but it begins to look as if on a smaller scale tank production might soon attain the same rapid expansion and dramatic intensity as airplane production The Army is in process of organizing two *panzer divisionen* and more are in prospect Each of these armored divisions will include 272 light tanks of 12-15 tons each and 110 medium tanks of 15-20 tons plus 181 scout cars—wheeled armored vehicles primarily for operation on roads And of course large numbers of tanks are assigned to non-armored divisions

The same financial factors that have delayed plane contracts have held up actual completion of tank awards but the Defense Commission has cleared orders with American Car and Foundry Co for over 1 000 light tanks to cost $21 749 000 Also cleared is a contract with White Motor for 500-600 scout cars totalling $5,387,500 Negotiations are under way with Chrysler to build a $16 - 000 000 plant government financed and manufacture about 1 000 tanks

In line with the usual parallelism of British and U S orders the British purchasing Commission has announced its intention to enter the tank market here and hopes to spend as much as $200 000 000 on 4 000 medium tanks at this time

The Army in the past has tended to favor the lighter vehicles and the 20-ton medium tank has been the heaviest in regular service Lately experiments with vehicles up to 30 tons have been made

A more far-reaching change is the decision to introduce heavy tanks – revealed when the Defense Commission distressed the military by telling that negotiations had been completed with Baldwin Locomotive to build $5 690 000 worth of heavy tanks No details on these have been announced but the Baldwin order is believed to cover about 50-75 vehicles Weight is thought to run to about 50 tons and they probably mount 75 mm guns Ordnance officers still feel that the 70 and 80-ton monsters used in the Battle of France are primarily of value for attacking fortifications—a problem they aren't worrying about for the present

$4,000,000 SPENT FOR TRACTORS

Allis-Chalmers and International Harvester have recently contracted for over $4 000 000 of tractors for hauling U S Army artillery This contract will not cause any disruption to their regular production

TOOL BUILDERS, REFUSED EXPORT LICENSES, TO GET RFC ADVANCES

WASHINGTON—Arrangements have been completed whereby the Reconstruction Finance Corporation will advance 90 per cent of the selling price of machine tools to the builders where export licenses for such machines have been refused The only provision is that such machine tools should be suitable for national defense purposes

The program is also designed to act as a cushion in case the European war should suddenly end It would enable machine tool builders with large British orders to continue production without interruption during a time when the U S Government would be arranging to take over such orders for delivery to U S plants working on defense contracts

To secure payment for his completed machines the builder must present to the R F C a warehouse certificate showing that the units are in storage ready for delivery to whatever point the government may designate It is understood that military authorities now are arranging for certain warehouses at key points to be tied in with the plan Before a company can secure payment of 90 per cent of the price it must obtain from the army and navy Munitions Board a certification that the specified machines are essential to national defense

Largest Japanese Investment Made In Machinery and Tool Industry

TOKYO More capital is invested in the Japanese machinery and tool industry than in any other Japanese manufacturing business At the end of March this year the total investment in the industry totaled approximately $703 794 000 while during the month of May alone expansions in the machinery industry included approximately $17 372 000 in capital increases and $621 000 of newly authorized share capital

At the same time the Cabinet Bureau of Statistics has disclosed that employment in the machinery industry has increased 102 per cent since July 1937 No other industry in Japan can boast a larger labor force

Meanwhile Japanese exports of machinery of every description reached a record total approximating $33 600 000 during the first four months of 1940 Exports in the same grouping during the corresponding periods in 1939 and 1938 were approximately $22 000 000 and $14 500 - 000 The average unit price of metal working machines was $345

Many observers indicate that Japanese imports of machine tools parts and accessories have decreased measurably

U. S. Government Contracts Awarded to Tool Makers

(Other defense [illegible])

Contractor	Govt Agency		
International Harvester Co , Inc Washington D C	Procurement	Tractors	$35 [illegible]
Caterpillar Tractor Co Peoria Ill	Procurement	Tractors	28 350
Kearney & Trecker Corp Milwaukee Wisc	Ordnance	Milling machines	51 160
Ex-Cell O Corp , Detroit Mich	Ordnance	Shell turning	52 280
Swind Machinery Co Philadelphia Pa	Ordnance	Planer	19 962
Niles-Bement-Pond Co Pratt & Whitney Div West Hartford Conn	Air Corps	Radial drills	36 450
The Heald Machine Co , Worcester Mass	Air Corps	Cylinder grinders	59 280
Niles-Bement-Pond Co Pratt & Whitney Div , West Hartford, Conn	Air Corps	Lathes	87 995
Cincinnati Milling Machine Inc Cincinnati Ohio	Ordnance	Milling machines	128 056
Ex-Cell-O Corp , Detroit Mich	Ordnance	Boring machines	15 767
Brown & Sharpe Mfg Co Providence, R I	Ordnance	Milling machines	107 325
Kingsbury Machine Tool Corp Keene, N H	Ordnance	Machines	20 799
Pratt & Whitney Div Niles-Bement-Pond Co , West Hartford Conn	Ordnance	Precision lathes	38 105
Leland-Gifford Co , Worcester, Mass	Navy	Drilling machines	25 951
Austin Hastings Co , Inc Cambridge Mass	Navy	Planer-shapers	22 862
Browning Crane & Shovel Co Cleveland O	Panama Canal	Cranes	199 200
Jones & Lamson Machine Co , Springfield, Vt	War Ordnance	Shell turning machine	41 461
Austin-Hastings Co Inc Cambridge Mass	Ordnance	Planers	51 837
Bay State Tool & Machine Co , Springfield Mass	War	Parts for rifles	34 136
W I Shipley Machinery Co Philadelphia, Pa	War	Screw machines	22 21 [illegible]
Austin-Hastings Co , Inc , Cambridge Mass	War	Turning lathes	60 000
The Bullard Co , Bridgeport Conn	War	Boring mill	20 467
Sebastian Lathe Co Cincinnati, Ohio	War	Lathes	36 851
C F Bulotti Machinery Co , San Francisco Calif	Navy	Twist drills	15 784
Worthington Pump & Machinery Corp , Harrison N J	War	Pumps engines	38 089
Gisholt Machine Co , Madison Wisc	Navy	Turret lathes	14 604
Brown & Sharpe Mfg Co Providence, R I	War	Milling machines	50 541
G A Gray Co Cincinnati Ohio	War	Planers	43 884
Kearney & Trecker Corp Milwaukee, Wisc	War	Milling machines	19 868
Monarch Machine Tool Co Sidney Ohio	War	Lathes	36 012
Cincinnati Milling Machine Inc Cincinnati Ohio	War	Milling machines	23 101

NAMES in the NEWS

O. E. Hunt, vice president and member of the administration committee of General Motors Corporation, was elected a member of the policy committee, with specially assigned duties. H. H. Curtice, vice president of the corporation and general manager of the Buick Motor Division of General Motors, was elected a director of the corporation to succeed Seward Prosser, who recently resigned. At the same time C. L. McCuen, general manager of the Olds Motor Works Division of General Motors, was elected a vice president of the corporation and transferred to the central office, in charge of engineering activities.

Meanwhile other changes occurred as S. E. Skinner, general manager of Ternstedt Manufacturing Division, became general manager of Olds Motor Works Division. J. W. Jackson, formerly works manager succeeds Mr. Skinner as general manager. F. C. Kroeger, general manager of Delco-Remy Division was appointed general manager of Allison Division. O. V. Badgley, factory manager of Delco-Remy Division, has been appointed general manager.

Major Austin C. Taylor and George W. Sweny have been appointed directors of the Boeing Aircraft Co. of Canada Ltd.

M. J. Tannes, Jr., A. H. Williams, and Ray P. Tennes, have been elected president, vice president and secretary respectively of Schafer Bearing Corp., Chicago, Ill.

Col. L. B. Lent, has been appointed executive secretary of the American Engineering Council to succeed Frederick M. Feiker.

Roy A. Watkins has been appointed works manager in full charge of manufacturing for Beech Aircraft Corp., Wichita, Kans. Formerly Mr. Watkins had been production engineer of Lockheed Aircraft Corp.

August H. Tuechter, president, the Cincinnati Bickford Tool Co., has recently celebrated his 55th anniversary as a member of the organization.

Henry K. Beebe, who had been superintendent of the Buffalo Ford plant for five years and also a traveling superintendent for the Ford Company, has been appointed plant engineer at the Bell Aircraft Corp. in Buffalo.

Charles J. Marks has been appointed chief tool engineer of the United Aircraft Corp. At the same time Arthur A. Merry and Frederick L. Woodcock were appointed to the positions of chief tool engineer of Pratt & Whitney Aircraft Division and Hamilton Standard Propellers Division respectively.

Craig Hampton, formerly connected with the Steel & Tube Division of Timken Roller Bearing Co., is now superintendent of maintenance at Copperweld Steel Co.'s new plant at Warren, Ohio.

M. A. Carpenter has been elected executive vice president and a director of the Falk Corporation, Milwaukee, Wis.

Harold Cammez, connected for many years with Allison Engineering Co., has been appointed executive engineer of Air Associates, Inc.

Charles R. Miller, Jr., has been named director of purchases of the United States Steel Corp. of Delaware. He takes over the duties of Charles H. Rhodes, vice president, who has recently been transferred to Chicago.

W. H. Milton, Jr. who has been sales manager for the General Electric plastics department at Pittsfield, Mass., has been appointed assistant manager.

Has Special Duties *New Director* *Elected Vice President*



O. E. HUNT H. H. CURTICE C. L. McCUEN

BUSINESS ITEMS

American Textile Engineering, Inc., Kearny, N. J., and its affiliated corporations, for so many years makers of textile conditioning machinery and liquids, have merged into a new corporation, Kearny Mfg. Co., Inc., with offices and shops at Kearny, N. J. and Greenville, S. C.

Springfield Electric Motor Co., Springfield, Ohio, has been appointed a distributor for General Electric Automotive Products.

Frederick Colman & Sons, Inc., manufacturers of tools, dies and special machinery for the automotive and aviation industries, will soon begin construction of a new $150,000 addition to its plant at Detroit, Mich.

Moves to Allison *With Olds Motor Works*



F. C. KROEGER



S. E. SKINNER

C. C. Kordenbrock, formerly with Lodge & Shipley Machine Tool Co., has just become associated with the Kordenbrock Machinery Co., Detroit, in the capacity of sales engineer.

F. A. Guiberson, Jr. and F. A. Guiberson, III, developers of the radial diesel engine, which is now being used in army tanks, have moved from Dallas, Tex. and opened offices at 310 S. Michigan Ave., Chicago, Ill.

Vultee Aircraft Co., Inc. will be acquired by the Stinson Aircraft Division of the Aviation Manufacturing Corp. by an exchange of stock.

Robert E. Prill, formerly with W. J. Holliday & Co., and others, has now established the Practical Welding Engineering Service at Chicago, Ill. Assistance and consultation service on welding procedures is offered.

Equipment Steel Products Division, Union Asbestos & Rubber Co., has purchased the galvanizing plant of the Rogers Galvanizing Co. at Blue Island, Chicago.

The Chain Belt Co. of Milwaukee, Wis. has just completed moving the manufacturing operations of its screw conveyor and light steel bucket division from its Chicago plant to West Milwaukee works of the company.

Browning Tool & Supply Co., Indianapolis, Ind., has been appointed exclusive representative in Indiana for the Geometric Tool Co., New Haven, Conn.

PLANT EXPANSION

Scheduled to be completed in three months is a new $260,000 addition to the plant of the Harrison Radiator Division of General Motors Corporation which was recently begun at Lockport, N. Y.

SKF Industries, Inc., Philadelphia, Pa., has purchased the Watson Shock Absorber plant in that city. The new acquisition, which contains 226,000 sq.ft. of floor space, will be devoted exclusively to the manufacture of anti-friction bearings.

A new plant being constructed by Air Associates, Inc. at Bendix, N. J., is near completion. The total floor area of the new building is 63,000 sq.ft.

A $2,000,000 plant addition is being completed for Boeing Aircraft Co. at Seattle, Wash.

Construction has started on the new $400,000 plant of the United States Electrical Motors, Inc. of Los Angeles, in Milford, Conn. The new building, a one-story structure, will cover about 50,000 sq.ft. of floor space.

At an approximate cost of $6,500, the J. W. Hewitt Machine Co., Neenah, Wis., is scheduled to erect an addition to its plant

Hydraulic Press Mfg. Co. plans to build a new plant at Mount Gilead, Ohio. The building is to be 400 ft. long and construction operations are expected to be under way in September.

At a cost of approximately $9,000, Allis-Chalmers Mfg. Co. will add a 24x26 ft. shop addition to its West Allis, Wis., plant.

Byron Jackson Co., pump manufacturers, of 2150 Slauson Ave., Los Angeles, Calif., will erect a new pattern shop, at Huntington Park, Calif., at a cost of $65,000.

OBITUARIES

Stanley P. Rockwell, 54, vice-president Stanley P. Rockwell Co., Hartford, Conn., was killed by an explosion aboard his cabin cruiser Aug. 11.

Killed in Accident



STANLEY P. ROCKWELL

Mr. Rockwell was one of the leading metallurgists of the country and the inventor of a hardness tester and dilatometer which bear his name. He also was the recipient of the Sauveur Achievement Award in 1939. He entered business for himself in 1920.

Carl F. Anderson, 73, president of Anderson-Shumaker Co., Chicago, Ill., has died. Mr. Anderson who organized his steel and iron works company in 1902, was also vice president of a Swedish engineers society.

Donald M. Smith, assistant district sales manager in the Chicago office of Allegheny-Ludlum Steel Corp., Pittsburgh, Pa., died recently at his residence in Chicago.

Karl W. Johnson, 78, president of the Commonwealth Screw Co., Worcester, Mass., died at his home in that city recently.

Adam A. Breuer, president and founder of the Breuer Electrical Mfg. Co., Chicago, Ill., has died at the age of 57. Prior to the organization of his own company in 1927, Mr. Breuer was with International Harvester Co. and with American Steel & Wire Co.

Jacob D. Ginther, 90, former vice president and general manager of Washington Iron Works of Buffalo, N. Y., died August 6.

William A. James, 69, chief engineer of the Lackawanna plant of Bethlehem Steel Corp., died suddenly August 2 while on a brief vacation. Mr. James had been connected with the steel plant since 1901.

Russell Harry Palmer, president of the National Machinery Co. at Vancouver, B. C., has died.

John Lowell Fyke, 55, general superintendent of Allis-Chalmers Mfg. Company's electrical and steam turbine shops, died recently.

Herbert W. Wolff, senior vice president, American Car & Foundry Co., died recently at the age of 67. Mr. Wolff had been associated with the company since 1899 when he was chief mechanical engineer.

MEETINGS

American Gear Manufacturers Association. The 23rd semi-annual convention, Skytop Lodge, Skytop, Pa. October 14, 15 and 16, 1940.

Porcelain Enamel Institute. Fifth annual forum, University of Illinois, Urbana, Ill. Oct. 16–18.

Society of Automotive Engineers. National tractor meeting, Schroeder Hotel, Milwaukee, Wis., Sept. 24–25. Annual dinner, Hotel Commodore, New York, N. Y., Oct. 14.

American Institute of Electrical Engineers. Pacific Coast convention, Los Angeles, Calif., Aug. 26–30.

American Society of Mechanical Engineers. Fall meeting, Spokane, Wash., Sept. 3–6

SHOP EQUIPMENT NEWS

Hanchett Travelling Wheel Face Grinder Designed to Finish Edges of Armor Plate

The No 700 travelling wheel face grinder developed by Hanchett Mfg Co Big Rapids Mich has been built specially for finishing edges of armor plate having a capacity for grinding plates 10 ft wide 45 ft long and up to 20 in thick

Grinding wheel is of the segmental type 48 in in diameter Each abrasive block has a 4x8-in grinding face Grinding wheel spindle 8 in in diameter is mounted on Timken tapered roller bearings and is driven through V-belts from a 125 hp motor Wheelhead has hand power and automatic cross feed and can be adjusted from the vertical to an angle of 30 deg Wheel carrier travels on one V way and one flat way each 6 in wide by means of a bull gear engaging a rack attached to the machine bed This feed mechanism is driven through a 15 hp reversing motor with controls for providing variable speeds Ways and rack are protected with bell covers and are lubricated with a forced feed system

Grinding is done wet A 1 hp centrifugal coolant pump is attached to a bracket at the left of the carriage This coolant pump travels along a channel-shaped coolant tank and delivers coolant onto both the wheel and work Current is supplied to the various units on the machine by bus bars and brushes completely inclosed in a cast iron guard attached to the rear of the bed Complete machine without work table weighs approximately 75 000 lb

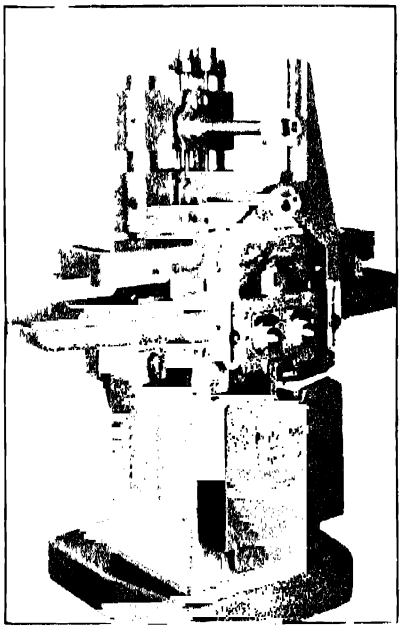
Double Spindle Milling Machines Split Bushings, Mill Piston Slots

Kent Owens Machine Co Toledo Ohio has introduced a line of milling machines equipped with double spindles especially suited for splitting bushings milling slots in pistons and other similar operations They can be used on a wide variety of other parts having two or more surfaces spaced from each other and which can be milled to advantage by using two cutters mounted on different spindles

Spindles are adjustable vertically and independently of each other by means of screws having micrometer dials Center distance between the two spindles is 4 in minimum and 11 in maximum

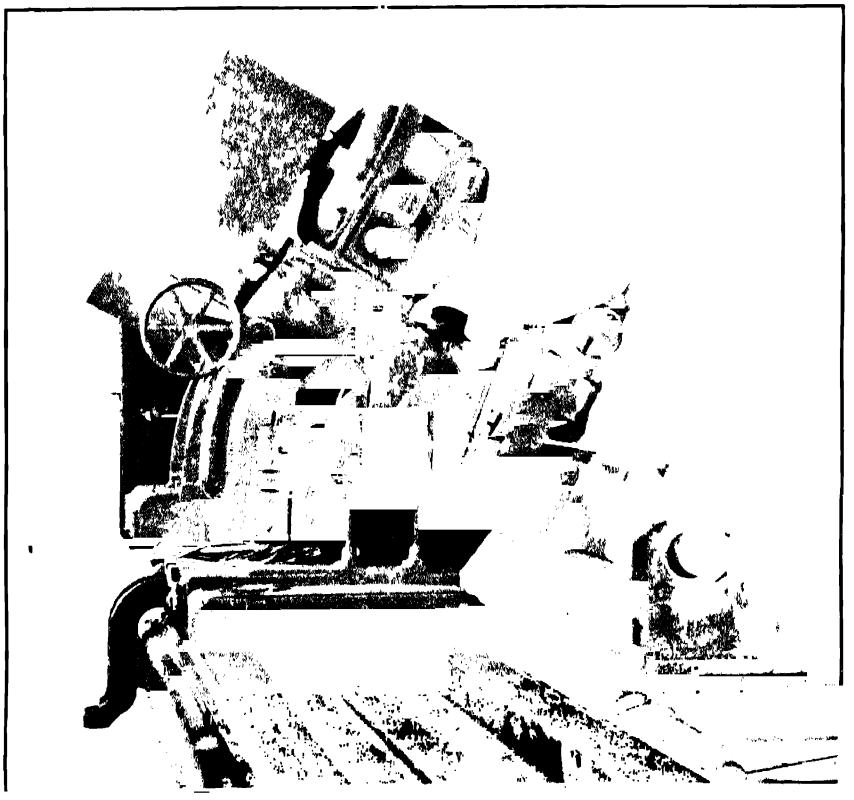
Center of the lower spindle can be brought to within 1 in of the table surface and center of the upper spindle can be raised to 17 in above the table surface Each spindle is independently adjustable horizontally This adjustment is 1 in and can be accurately controlled by means of micrometer dials

Spindle heads are supported on



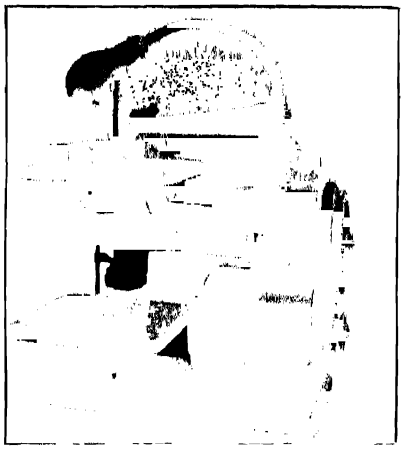
two round cylindrical steel posts Drive is from a standard foot mounted ball bearing motor at the rear Machine is furnished complete with spindle drive motor hydraulic pump motor all hydraulic equipment and all electrical equipment

Two panel dials control the table feed from to 80 in per min one dial being used for fine feed the other for coarse Shown in the illustration are double spindle mounted on the No 1 14 hydraulic milling machine This machine has a 14 in table travel and a 9x32 in table Double spindle arrangement can also be applied to the No 1 M and 1 8 machine



Duplex Punch and Die Filer Has Universal Tilting Table

A combination bench-type double purpose filing machine distributed through Marburg Brothers Inc 90 West St New York N Y has been



built especially for finish filing punches and dies Among its features are (as a die filer) table which tilts to any compound angle, stroke fully adjustable from 0 to 1½ in , file fully supported over entire stroke, and (as a punch filer) table which tilts 10 deg two ways, stroke fully adjustable to suit punch flange, automatic stopping of file

When the unit is used as a die filer, the upper table is swivelled into working position for the conventional type of filing The file holder operates from below and the file penetrates the die When used as a punch filer the upper table is tilted out of the way and the lower table is then ready for filing The punch file operates from the top but does not penetrate the table Instead, the file movement is accurately controlled by an adjustable stroke

Both tables, 10 in square, are accurately ground File support is of a recessed design, and file holders are guided in prismatic ways with adjustable gibs Crank drive with a range of 0–1½-in stroke can be used as a permanent drive, or set as a friction drive incorporating a safety clutch which automatically stops the stroke should the file hit an obstruction

Regular machine files can be used on the device Standard equipment includes a ¼-hp 110 volt a c motor located inside the frame and two-step pulley V-belt drive

'Progress-O-Matic" High Speed Spot Welder Produces More Than 6,000 Welds per Hour

Capable of making upwards of 6,000 spot welds per hour, the "Progress-O-Matic" high speed spot welder announced by Progressive Welder Co , 3001 East Outer Drive, Detroit, Mich is claimed to produce better welds than possible with conventional welding equipment of even lower production capacity This machine, the first of which is now in operation on 1941 automobile body work, uses a method of current transfer which makes and breaks the secondary as well as the primary circuit, thus giving the machine such flexibility of operation that it can weld an assembly having several thicknesses of metal

With the new design, all welding points are brought down on the work under full pressure and held there throughout the entire welding cycle Since points are already on the work before the current is on and remain there after the current is off, chance of burned welds is virtually eliminated Machine is provided with quickly interchangeable lower electrodes to accommodate different size assemblies. Model illustrated makes 36 spots to join the two halves of two sizes of automobile hood tops

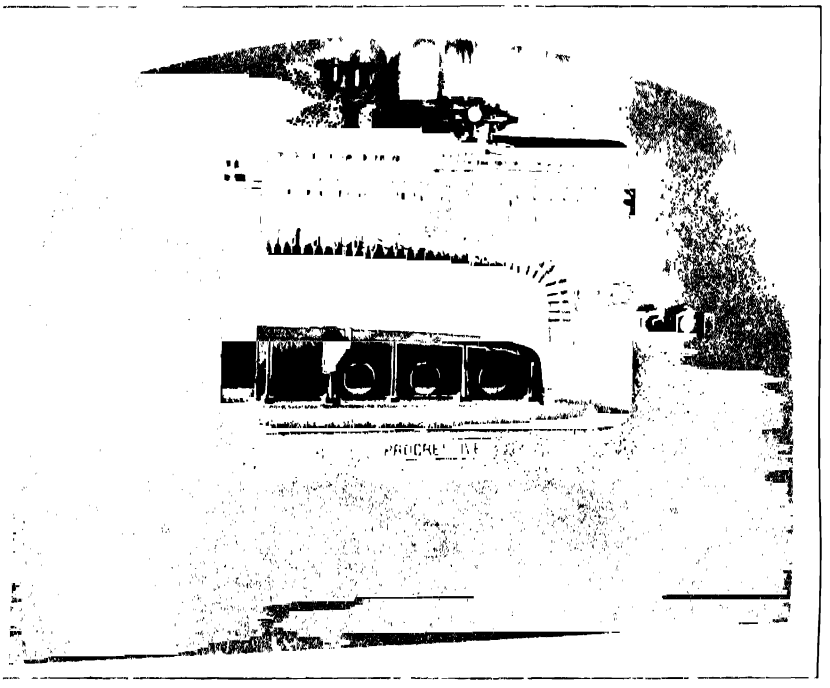
In operation, pieces are loaded into the machine from front and back Operator then touches control button to raise work to welding position This is accomplished through four air cylinders At the end of their stroke an automatic valve is tripped and additional cylinders superimpose a wedging support for the central portion of the work table All welding points are thus effectively brought up to the desired predetermined pressure Machine then automatically begins its welding cycle When completed, the table returns to open position and the work is unloaded through one end of the machine

The new design permits such rapid distribution (timing) of current that only one transformer is required A ¼-hp air motor drives an indexing disk which has a single port near its edge Synchronized with the operation of this disk are two automotive-type distributors When the port in the disk comes into alignment with a similar port in the timing chamber it permits a charge of air to close one of the contact guns This gun closes a secondary connection between transformer and work

Welding current circuit flows through one gun through the lower electrode, and up through another gun Thus two welds are made at once in series All 36 welds are made during one complete revolution of the timing disk

Each air-operated contact gun consists of a cylinder with two split pistons, the upper piston being cut diagonally When air from the timing port enters this chamber it forces the piston down, to establish contact with a bus bar and also forces the piston to one side to make positive contact with the side of the cylinder The latter is connected with its respective welding point Connection is broken by a return spring

All welding points can be adjusted to a predetermined pressure by means of high-pressure springs A calibrated scale on each welding gun permits direct reading of pressure Timing method permits timing up to 24 cycles; sufficient, it is said, to handle the heaviest type of high-production work now being welded Interrupted timing, also a requisite for extremely heavy duty welding, is also possible through a few changes in the timing mechanism

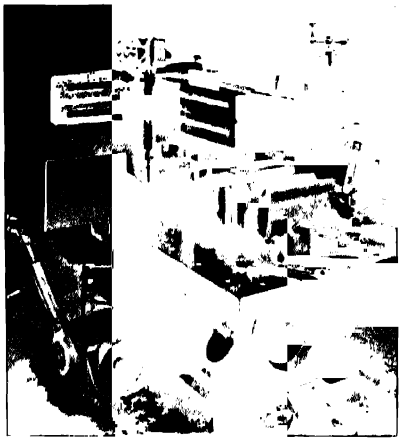


Automatic Form Shaping Possible with Duplicator

Automatic form cutting with a shaper through the use of a form duplicating control utilizing a simple die duplicator produced by the Detroit

Universal Duplicator Co., 249 St Aubin St., Detroit, Mich., is said to permit considerable saving of cost and time. A typical application which arose recently was the problem of machining the sides of magnesium crankcase and barrel core boxes to provide for the application of steel wear plates.

Normally such a job would be milled with frequent checking, at a floor-to-floor time of roughly three hours per piece. However, with the die duplicator hooked up to the shaper and a template provided, machining time was reduced to about 30 minutes, at a saving of some 80 per cent. Checks indicate that a consistent accuracy of within 0.002 in. can be maintained.

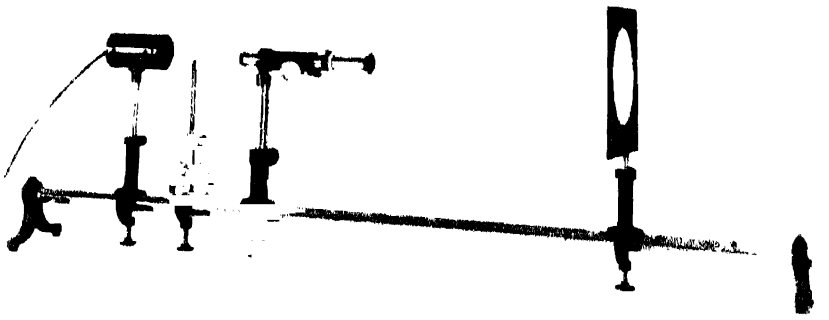


Steel template is mounted on machine table. A tracing finger, supported by a tracer head mounted with a bracket on the shaper, follows the contour of this template, controlling vertical feed, while transverse feed is automatically governed by the setting of the shaper. Work itself is clamped in duplicate to the table so that several pieces can be machined at one time.

Versatile Projection Comparator Uses Standard Optical Parts

Using standard optical bench parts, such as are frequently employed in research laboratories, a projection comparator offered by Gaertner Scientific Corp., 1201 Wrightwood Ave., Chicago, Ill., provides magnification of 50 times or more. Cost is low, parts are interchangeable so that other equipment may be added as desired, and individual parts such as microscopes, high power lamps, etc., can be put to other important uses in the shop.

Projector consists of a high powered lamp operating from a 6-volt transformer, which shines light into the horizontally mounted microscope. At the end of the unit is the ground glass screen on which the image appears. Between light source and microscope is mounted a standard



swivel clamp holding a rod having its upper end threaded, to which can be attached a small platform with centers, V-block, or other methods of holding the object.

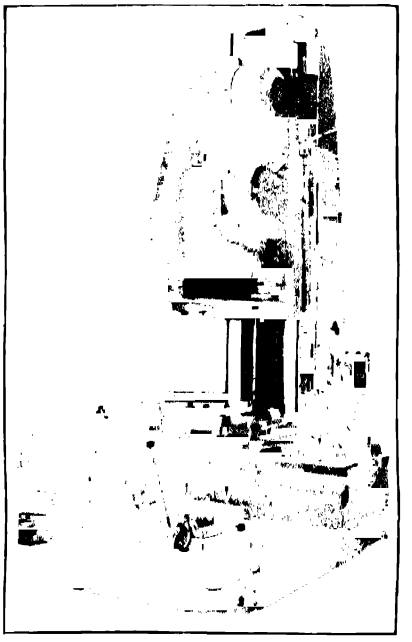
In operation, the part to be examined is placed in an object holder improvised by the user on top of the vertical rod in the swivel clamp, and the clamp moved back and forth in front of the microscope until an image of the object is focused on the screen. Final focusing can be accomplished by the rack and pinion on the microscope. For measurement of screw threads the swivel clamp is rotated to correspond with the helix angle.

Image is clearly visible in a well-lighted room, but for best results screen should be shielded from direct light. In place of the ground glass screen, translucent drawings can be substituted with which the object can be compared. No refocusing is necessary. A standard microscope will give magnifications up to about 50 times, and it is possible to obtain greater magnifications by interchanging microscope objectives.

Moline Single-Spindle Boring Machine Uses Hydraulically Actuated Table Motions

Hydraulically actuated motion of the table in conjunction with hydraulic feed of the spindle carriage is one of the unusual features of the No. HF-145 single-spindle boring machine built by Moline Tool Co., Moline, Ill.

Boring spindle of this machine is mounted in heavy roller bearings and is driven through a set of quick change gears, adjustable for four different spindle speeds ranging from 26 to 84 r.p.m. Feed of the boring spindle is hydraulic and can be set for automatic operation, or can be controlled by hand if desired.



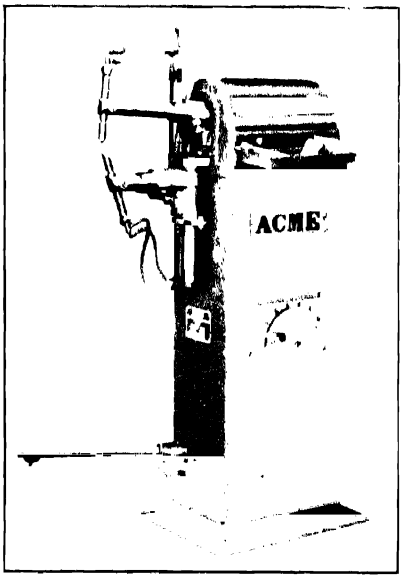
Rectangular work table is movable by hydraulic pressure at either the rapid traverse or feed rate, toward or away from the machine column and to right or left. Machine illustrated is equipped with a round rotatable T-slotted table which can be set on the rectangular work table when required.

Hand lever used to control vertical travel of the boring spindle carriage is also used to control motions of the table. Only one of these motions can be operative at any time because of mechanical interlocking of valves in the hydraulic circuit. A three-position selector lever is provided which is set to determine which of the three motion-producing hydraulic cylinders will be connected to the hydraulic feed unit. Feed travel for any of the hydraulic motions can be varied from zero to maximum by a small lever which is linked to the volume control lever of the hydraulic unit.

Vertical spindle carriage travel is 36 in., table travel to and from column is 20 in., table cross travel is 40 in., and distance from floor to surface of rectangular table is 36 in.

Acme "Hot Spot" Welders Permit Quick Horn Changes

An improved line of "Hot Spot" foot-operated rocker arm type spot welders has been made available by Acme Electric Welder Co., 5621-23 Pacific



Blvd., Huntington Park, Calif. The Type O machine with stationary lower horn holder and the Type 1 with swivel lower horn holder are manufactured in 10, 15 and 20 kva capacities, and in throat lengths of from 12 to 36 in. They are furnished complete with water cooling equipment.

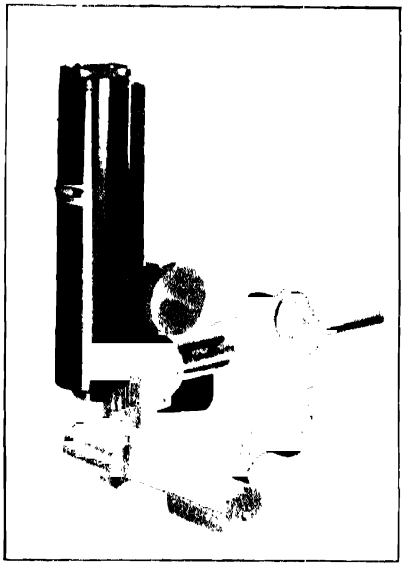
A clamping block device retains the horns in the horn holders with ideal electrical contact, yet half a turn of a $\frac{5}{8}$-in. setscrew instantly releases them for a change of set-up. Horns are universal double end reversible, with one end machined to hold electrodes at an angle of 90 deg. and the other end taking electrodes at a 22½ deg. angle.

Angle-Head Attachment Features Compact Case

A close-corner angle-head for use in drilling and filing with flexible shaft machines has been made available by Stow Mfg. Co., Binghamton, N. Y. Compact dimensions of this unit make it usable in very confined quarters. Over-all dimension from the drill socket to the top of the case is only 2⅛ in., while that from the spindle center to the outside of the case is but $\frac{9}{16}$ in.



This unit has an aluminum housing containing two single-row ball bearings, back to back, on the vertical spindle, and a single-row ball bearing combined with a needle bearing on the horizontal spindle. With this equipment, high thrust capacity is achieved. With a chuck screwing onto the vertical spindle, the attachment will accommodate drills, files, etc., with shanks up to ¼ in. For closest work, short drills with $\frac{3}{16}$ in. shanks may be inserted directly into the spindle and held by a setscrew.



Optical Thread Tool Gage Permits Rapid Checking

Rapid yet accurate set-up of single point threading tools is made possible by an optical thread tool gage developed by Gaertner Scientific Corp., 1201 Wrightwood Ave., Chicago, Ill. This instrument, which also serves for checking tool and thread angles, consists of a specially mounted microscope with an unusually large eyepiece field of $\frac{7}{8}$ in., in which appear the characteristic angles of American National Standard, Whitworth, and metric threads. Microscope, which has rack and pinion focusing, is mounted on a keyed cross-rod which slides for adjustment in a reamed hole perpendicular to a mandrel in the base.

For setting up the threading tool perpendicular to the axis of the lathe centers, the female centers of the instrument mandrel are placed between the lathe centers and the cross-rod adjusted until the point of the threading tool is in the field of the microscope. Threading tool is then adjusted in the toolpost until its outline coincides with the corresponding angle in the microscope. In this way, the thread tool will be set perpendicular to the lathe center axis within 2 min. of arc. The angle of the tool itself is checked to the same accuracy.

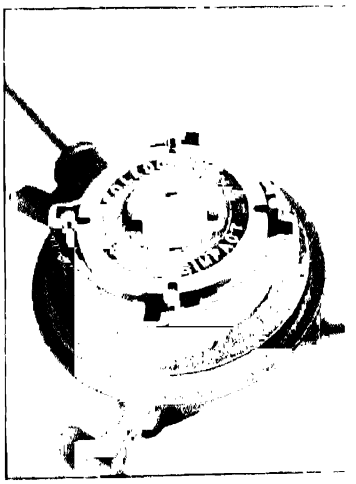
To check thread angles on work, gage is simply placed on top of the work and the cross-rod of the instrument slid out until the thread appears in the field of the microscope. Accuracy is greater for small leads. A V ground in the bottom of the mandrel facilitates positioning it.

The instrument is suitable for work from $\frac{3}{8}$ in. to 6½ in. in diameter. Magnification is about 12 times. It is supplied with a hardwood instrument case.

Toledo Ratchet Threader Permits Rapid Die Changes

A feature of the "Simpact" self-contained 1- to 2-in. ratchet threader offered by Toledo Pipe Threading Machine Co., Toledo, Ohio, is that the high-speed steel dies are quickly changed from one size to another simply by pushing the size selector buttons and slipping the dies in the proper steps. Thus approximately half the time usually required to change sizes is said to be saved.

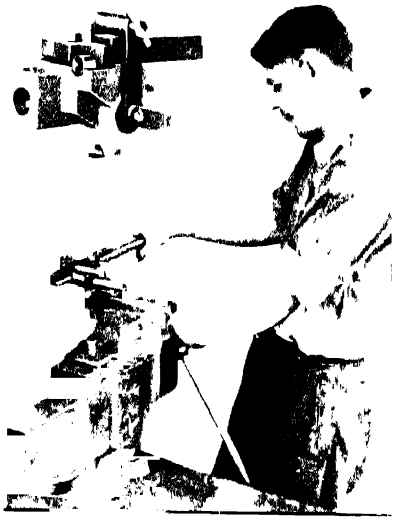
Dies are backed by tapered steps, so that smooth, long tapered threads are assured. A three-jaw rear gripping device is employed. It is equipped with three broad-faced chuck jaws, graduated guide posts, and large winghead thumb screws to assure accurate centering of the tool on the pipe. The 24-in. tubular steel handle is strong and light, and the tool is said to be lighter than any other self-contained model. Dies are deep throated and may be resharpened many times.



Greenlee Hand Tube Benders Make Bends Without Flattening

Greenlee Tool Co., Div. of Greenlee Bros. & Co., 12th St. & Columbia Ave., Rockford, Ill., has added a line of hand-operated steel tube benders to its line of hydraulic benders. Developed to meet the requirements of

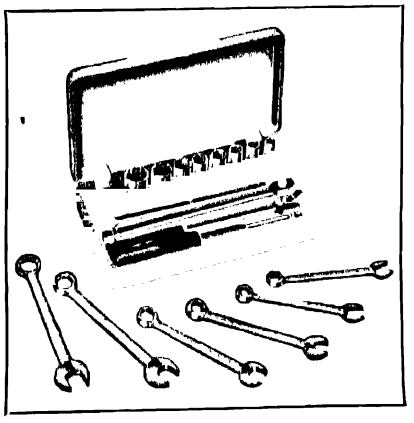
speed and accuracy in the bending of steel, copper, brass, and other tubing, as used in the machine tool, aviation, air conditioning, and refrigeration industries, these benders feature a design which is claimed to permit the bending of tubes without kinking or flattening. Bending is done by rolling action rather than sliding, which minimizes friction and leaves the finish of the tube unmarred.



Six sizes are available for bending tubes having outside diameters of 1/4, 5/16, 3/8, 1/2, 5/8 and 3/4 in. All are claimed to make smooth, even bends to a center line radius of 2½ times the outside diameter of the tubing. Benders are ordinarily held in a vise but a tapped hole in the head permits using an auxiliary handle for bending small sizes of soft tubing without a vise.

"Nuggies" Wrench Set Comes in Plastic Case

By using a high grade steel known as "Hexite", Blackhawk Mfg. Co., 5025 W. Rogers St., Milwaukee, Wis., claims new compactness and strength for a line of midget socket wrenches. These wrenches, called "Nuggies", have a 1/4 in. square drive. Socket sizes range from 3/16 in. to 7/16 in.

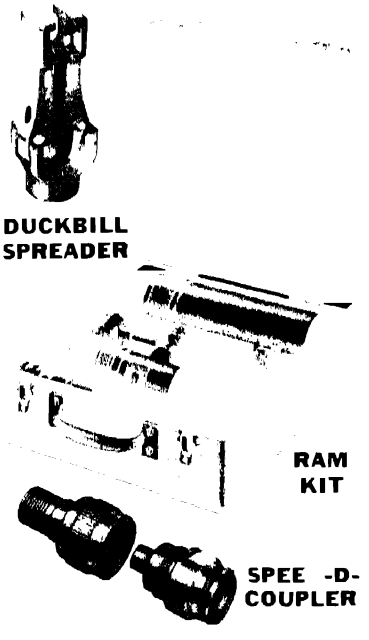


Miniature "half and halfs" (combination open end and box type wrenches) accompany the midget socket wrenches in the new 18ND set which is furnished in a 5½ x 3 9/32 in. red and black plastic container that slips into the coat pocket. The "half and half" have openings from 7/32 to 3/8 in.

Having a polished chromium finish, these tools are designed for professional work on carburetor, magneto, ignition, radio, airplane and other delicate jobs involving small assemblies. They are supplied in an attractive pocket-size two-color container of Durez plastic.

"Porto-Power" Units Now Offered in Sets

A number of improvements in the line of "Porto-Power" hydraulic equipment offered by Blackhawk Mfg. Co., 5025 W. Rogers St., Milwaukee, Wis., has made possible the assembly of a complete ram kit containing 4, 7 and 20-ton rams, plus a special coupler for present owners of the 10-ton hydraulic unit. This coupler, known as the "Spee-D-Coupler", makes it possible to connect the same pump and hose to any one of these rams. Coupler, which joins the high-pressure hose to the ram, seals an oil channel that transmits



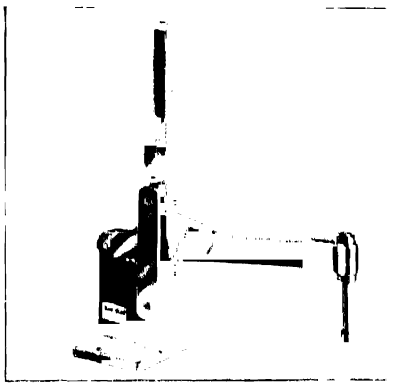
10,000 lb. per sq. in. pressure. Yet it can be disconnected with a twirl of the finger.

A new "Porto-Power" development is a thimble-size 4-ton ram which is only 1⅝ in. in height and diameter. This ram has been created to exert pressure in remote assemblies where large-size tools or hands cannot be inserted. It can be fed into small openings or channels because it is operated remotely on the end of an 8-ft. hose when assembled with the pump.

Another new attachment in the "Porto-Power" line is the "Duck Bill" spreader which adapts the plunger action of the 10-ton ram to spreading sheet metal and other assemblies. The jaws spread from 1½ to 6 in.

Cam-Action Toggle Clamp Handles Various Stock Sizes

The "Knu-Kam-Klamp" cam-action toggle clamp offered by Knu-Vise Inc., 16841 Hamilton Ave., Detroit, Mich., overcomes the disadvantage of standard toggle clamps by permitting the clamping of more than one thickness of stock at one set-up. The adjustment range is from to 1 in.



depending on the portion of the toggle bar used for clamping.

Clamp is made in two sizes, both interchangeable with the standard Type 110 and 250 toggle clamps. Action is similar to that of a toggle clamp in that both types have a clamping bar hinged at one end, an operating handle and a base member for attaching to the fixture. Link connecting handle to toggle bar is slotted to permit this bar to be rapidly withdrawn from the work but plays no part in the clamping operation. Upper portion of the toggle or clamping bar is machined to a cam surface against which two rollers are in contact at all times. When the handle is vertical these rollers contact the low part of the cam surface and the toggle bar is in position to take the thickest part being held in the fixture. Continued swinging of the handle forces these rollers against the cam rise so that the bar is in the minimum clamping position.

C-F Welding Positioner Revolves Through Full Circle

Recently added to the line of welding stands offered by Cullen-Friestedt Co., 1300 S. Kilbourn Ave., Chicago, Ill., is the Model 12 positioner with



a capacity of 1200 lb Like other positioners of the line, this model can be tilted a total of 135 deg from the horizontal, and the table can be revolved through a full circle regardless of the angle of tilt

Table is removable for attachment of special jigs or fixtures and is adjustable in height By mounting the positioner operating mechanism on a special base, extremely large and bulky work can be fully rotated when tilted without any interference from floor or pedestal mounting

This unit can be furnished fully powered with independent motor and controls for table tilt and table rotation Power for table rotation can be furnished with either constant or variable speed drive It can also be furnished for manual operation with independent handwheel for table tilt and table rotation, or a combination of manual and power operation

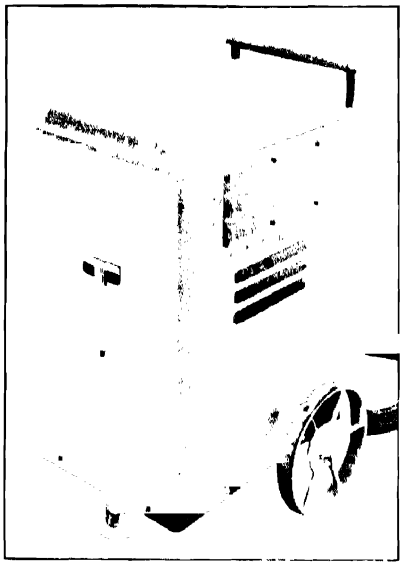
It is claimed that the universal table adjustment of this positioner reduces the number of passes required, reduces rod consumption and assures better welds by permitting all work to be done in a horizontal trough Much welding, hoist and crane time is saved by positioning assemblies and, with variable speed power operated table rotation rod may be held in one position while work is rotated at proper welding speed Table is self-locking in any position

Flex-Arc Portable Welder Designed for General Service

A modern all-purpose portable a c welder designed for all-round general utility service and production welding has been developed by Westinghouse Electric & Mfg Co, East Pittsburgh, Pa Standard models operate on either 220 or 440 volts, are completely self contained, and incorporate several distinct new design features

From 20 to 250 amp of welding current is available in 27 steps, with increments properly proportioned to meet the needs of welding with a wide variety of electrodes A built-in "De-Ion" circuit breaker insures protection against sustained overloads Open circuit voltage is exceptionally low, being on the order of 80 volts at 20 amp and ranging down to 50 volts at the highest current rating

Welder is completely self-contained, being inclosed in a steel case mounted on three wheels High efficiency, high power factor, and low no-load losses



insure maximum operating economies It is furnished complete with all accessories, including welding helmet with lens, electrode holder all leads and a 17-lb assortment of electrodes

Cleveland Tramrail Carrier Lifts, Carries, Empties Boxes

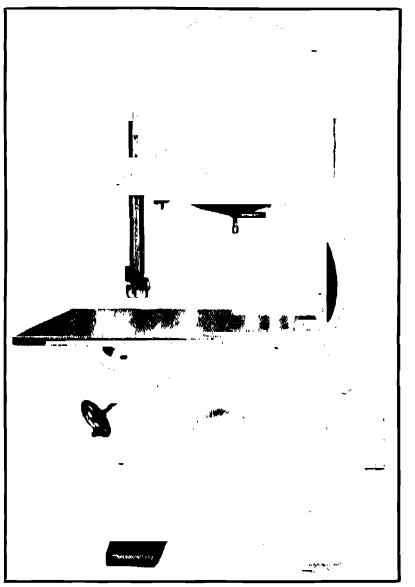
Cleveland Tramrail Div, Cleveland Crane & Engineering Co Wickliffe Ohio has developed a tilting box grab and tramrail carrier that picks boxes up, sets them down or empties them by tilting, all operations being manipulated by controllers in the cab

Equipment consists of a cab-operated motor-driven carrier with two independent hoisting units and motorized grab It is possible to raise or lower boxes as desired and empty them as fast or as slowly as may be required

Boxes used with the grab are provided with four suspension brackets, two on each side Motor-driven sliding latch bars in the grab may be extended into or retracted from the suspension brackets by the operator In operation the grab is passed between the suspension brackets and stopped at proper position by heel of grab which is brought against end of box Even at distances of 30 or 40 ft below the carrier, boxes can be picked up or spotted easily and quickly No floor men are required Suspension brackets make it possible to interlock the boxes, thus facilitating stacking in even tiers



Unit illustrated was designed for handling 3 tons, although units of any size up to 5 tons may be furnished Carrier travels on arch-beam rails at 300 ft per min Tote boxes, spool boxes and other containers may be handled with this equipment



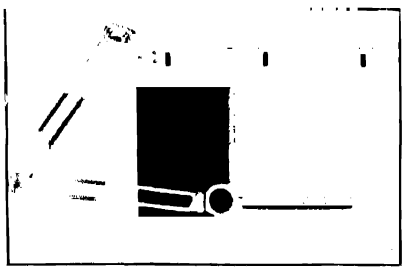
Tannewitz Bandsaw Eliminates Hazards of Broken Blades

The hazard of a broken bandsaw blade whipping around is said to have been completely eliminated in the high-speed bandsaws offered by the Tannewitz Works, Grand Rapids, Mich, in which two hydraulic brakes automatically bring both wheels to a stop the instant a break occurs

Brakes are automatically applied when current is shut off This occurs in the case of saw blade breakage by means of a saw tension lever which snaps back the instant the saw breaks, pressing the button which automatically shuts off the current and applies the brakes. A further advantage of this feature is that both wheels may be stopped instantly without throwing undue strain on the saw blade

Two New Series of Drawing Machines Offered by Drafto

The Drafto Co, Cochranton, Pa., has placed on the market two new series



of drawing machines. Of the portable type, there are seven new models in the series.

The three models in the 30 series have specifications as follows: No. 30H-6-8, which takes 12x18-in. sheets and is sold complete with 6 and 8 in. detachable scales; No. 30V-6-8, which is a vertical type, but in other respects identical with the model above; the No. 30U-6-8, which is sold unmounted, but which is otherwise identical with the Model 30H-6-8.

The four models in the 35 series have the following specifications: No. 35H-8-10, which takes 15x20-in. sheets of drawing paper and is sold complete with 8 and 10 in. detachable scales; the No. 35U-8-10, which is sold unmounted, but is otherwise identical with the model above; the No. 35C-8-12, which takes 18x24-in. sheets of paper and is sold mounted on a 23x31-in. seasoned wood board, complete with 8 and 12 in. detachable scales; the No. 35CU-8-12, which is sold unmounted but with a mounting bracket, and complete with 8 and 12 in. detachable scales.

In both these series the protractor is made of stainless steel with all graduations machine cut. A vernier permits setting the machine to ½ deg. Boards, except that on the Model No. 35C-8-12, are of green masonite. Arms are made of chrome steel with a bright chrome finish on top and a dull chrome on the bottom. All other parts are finished in dull chrome. Finish on the protractor is a circular polish making it easy to read. A latch makes it possible to lock the protractor accurately at 0, 30, 45, 60 and 90 deg. on either side of the zero mark.

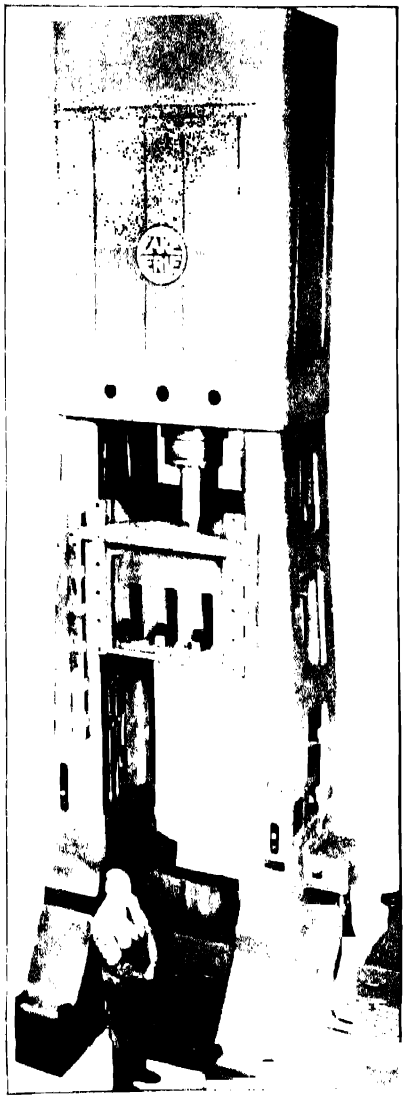
Fluorescent Lamp Developed For Low Bay Industrial Areas

An open-end twin-lamp fluorescent luminaire, utilizing 40-watt, 48-in. Mazda Type F white or daylight lamps and offered by Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., has been designed especially for general or supplementary lighting of low bay industrial areas. This unit, the Type FPR, is available only in the spread distribution style for operation on 110–125, 199–216, and 220–250 volts, 60 cycles a.c.

Luminaire consists of a hood, reflector, lamp holders, starting device, and ballast equipment. Hood is of fabricated sheet steel and carries the hinged porcelain enameled steel reflector which provides high over-all efficiency with a light cut-off of 72½ deg. from the vertical. Lamp starter is completely self contained in an aluminum housing which plugs into a socket located in the fixture hood; thus it may be replaced for maintenance as easily as lamps themselves. Two-lamp ballast with starting compensator is used to provide a power factor of 95–99 per cent.

150-Ton Hydraulic Press Draws Cartridge Cases

An unusually long stroke 150-ton hydraulic press built by Lake Erie Engineering Corp., 268 Perry St., Buffalo, N. Y., has been especially designed for drawing cartridge cases. Having 108 in. daylight and a stroke of 76 in., this press has a solid housing with a gib-guided platen. Adjustable knock-out bars are provided for other types of work, thus making it convertible to an all-purpose press.



Conveniently located pushbuttons control inching, semi-automatic and full automatic operation. Adjustable control of working pressure and stroke contribute flexibility to suit various operations, and save die setting time. Top of the press is completely inclosed in removable panels. A high-speed pumping unit provides fast approach and return of the moving platen.

Protection to Welders Afforded by "Ply" Cream

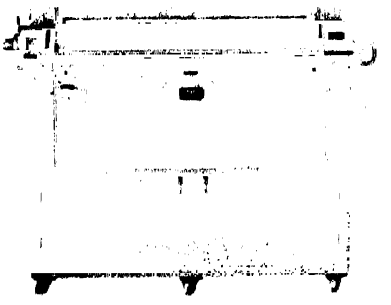
Protection to welders and cutters, especially when large diameter rods are being used, with resultant flashes, is given by "Ply" No. 8, a vanishing cream offered by Milburn Co., 905 Henry St., Detroit, Mich. Use of this cream make it possible for welders and cutters to work scantily clad, for comfort during hot weather, without danger of burning from the ultra-violet and infrad-red rays.

Ply No. 8 is applied like a vanishing cream, rubbing into the skin completely dry and practically invisible. Its ingredients form an effective block to the rays to prevent burning

Ozalid Whiteprint Machine Comprises Compact Unit

A fast-printing whiteprint machine developed by the Ozalid Corp., Johnson City, N. Y., has been built to serve a market for which printers equipped with low-pressure mercury vapor lamps are too small and high-speed reproduction machines are too expensive. In the Ozalid Model F, the printer and dry-developer are combined in one compact light-weight unit which can be easily installed in any print room or drafting room. This machine includes all facilities necessary to produce finished dry-developed whiteprints in less than two minutes. Yet it requires less than 14 sq.ft. of floor space and is claimed to use less than one-half as much electrical energy as other types of printers having equal capacity.

A new high-pressure mercury vapor lamp with an output of 40 watts per inch and an active length of 46 in. gives printing speeds ranging up to 56 in. per min. Original and sensitized materials are held in contact with a 4¼ in. glass cylinder which



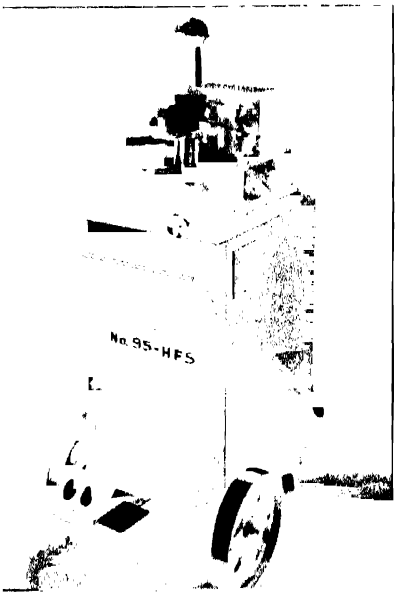
revolves around the stationary lamp An adjustable light shade permits the operator to vary exposure without changing the printing speed Cooling of the lamp is provided by a two-stage blower.

Machine is driven by a resiliently mounted split phase ¼ hp motor. The developer is driven by the motor through a specially designed 50 1 reduction gear, and the printer through a friction disk type variable speed transmission, providing printing speeds of from 4 to 56 in per min

Portable Butt Welder Handles Stranded Wire

Eisler Engineering Co 740 S 13th St, Newark, N J, has developed a portable butt welder with a burr grinder and annealer mounted on a fabricated case which is especially suitable in the repair of stranded wire By fusing all the strands, the ends are prevented from unraveling Final steps are then to butt weld the two ends and to grind off any burrs that may have appeared during the operation

Grinder has an accurate adjustment to compensate for abrasive wear There are two special bush-



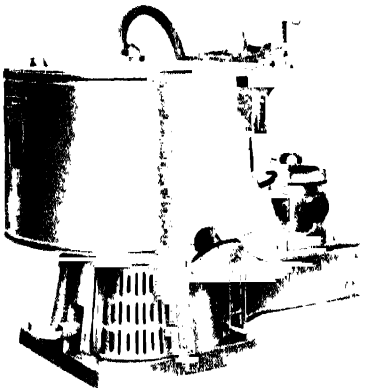
ings to guide the stranded wire to the grinder which squares off the ends in order to make neater welds All wiring has been concealed within the fabricated case and a draft tube has been provided to remove grinding dust

Machine is supplied with a 3-kva air-cooled transformer and an 8-point variable switch for current regulation Unit is foot operated, and butt jaws can be water-cooled for continuous service Metal from 1/16 to 3/16 in in diameter can be welded For butt welding other sizes, units are available with transformers ranging from 1 to 7½ kva capacity.

Tolhurst "Centriforce" Washer Cleans Small Metal Parts

A centrifugal which washes, rinses and dries small metal parts in one machine has been announced by Tolhurst Centrifugal Div American Machine & Metals, Inc, East Moline, Ill Known as the "Centriforce" washer this unit is designed for use in machine shops and plating plants

As a detergent washer, the machine washes screw machine parts with hot detergent solution to remove oil, grease dirt or fine chips. As a rinser the work is spun in the centrifugal while a spray of hot water

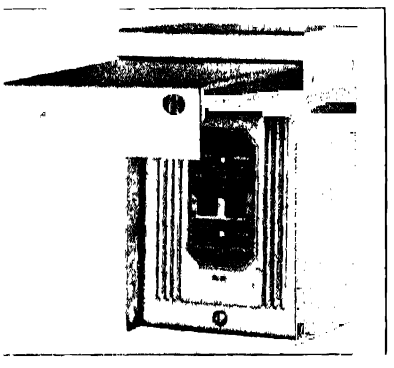


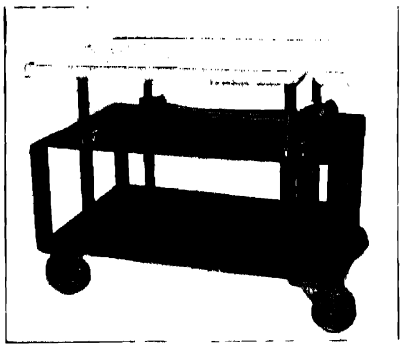
swirls through the parts As a dryer (use of sawdust is eliminated), the machine is revolved at high speeds while blasts of hot air are forced through and around the parts Up to 25 batches an hour are handled in the unit

Raintight Inclosures Developed For Type MO "Multi-breakeR"

The Square D Co, Detroit, Mich, has developed a raintight inclosure for the 25-amp frame Type MO "Multi-breakeR" This inclosure is a galvannealed steel hood which can be used to inclose any standard surface Type MO unit

Cover is removable for easy wiring Outside dimensions are 7 in high, 4½ in wide and 3¾ in deep Provision is made for padlocking the cover





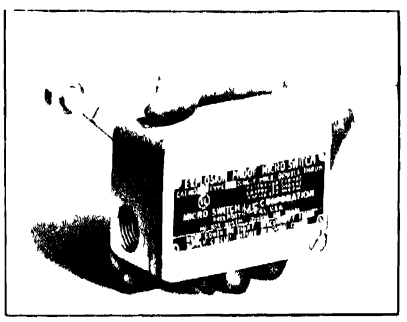
Flat Top Die Trucks Feature Welded Construction

Two new types of flat top die trucks have been announced by O Johnson Mfg Co, Dept K, 6027 W Roosevelt Rd, Cicero, Ill Of rigid electric-welded construction, these trucks are made for long and useful service

The simplicity and ease of operation of these units is claimed to make them particularly valuable for transferring and supporting dies They are equipped with rubber cushioned heavy duty ball bearing casters for easy handling The No F-1 truck has a 28x40-in table and a capacity of 3 000 lb The No F-2 has a 24x32-in table and a capacity of 2,000 lb Both provide an adjustable table height of from 24 to 40 in

Micro Switch Housing Is Explosion Proof

An unusually compact housing for the Micro Switch element has been developed by Micro Switch Corp, Freeport Ill, especially for use in explosive atmospheres Measuring only 3 ¼x2½x2 in, this explosion-proof housing is listed by the Underwriters' Laboratories for hazardous locations of Class I, Groups C and D and Class II Group G These groups include atmospheres containing vapors of ethyl ether, gasoline, alcohol, ace-

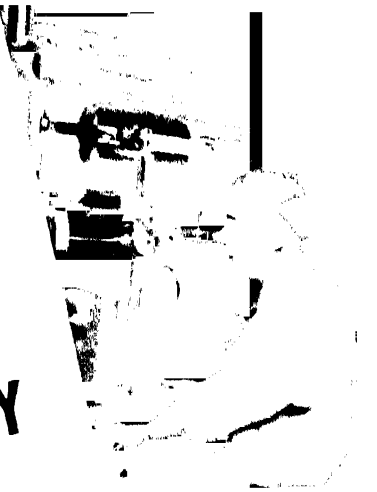


tone, lacquer solvents, etc, and grain dusts

Types of actuation available with this housing are roller arm with roller axis either parallel or at right angles to the arm, and a bullet nose push rod type All types have precision characteristics with a maximum movement differential of 0 001 in Mounting space is kept at a mini-

TEST AFTER TEST

...TO MAINTAIN MILWAUKEE QUALITY





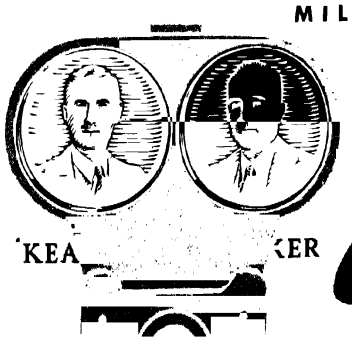




TEST after test — severe and exacting — determines the fitness of every item of material and workmanship in a Milwaukee Milling Machine.

A large staff of highly trained technical men is concerned solely with the constant testing, checking and inspection—at every stage of manufacture—that safeguards Milwaukee quality and performance-accuracy.

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Model K Vertic
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KEA ER

Milwaukee MILLIN MACHINE

mum by omitting feet and lugs and providing a pair of tapped holes on each of the four sides Removable cover plate provides access to terminals supported on the switch element itself This element is the standard Micro Switch having a rating of 1,200 watts at up to 600 volts a c

Lincoln 400-Amp. Diesel Welder Has Gasoline Engine Starting

Application of gasoline engine starting to its line of diesel driven arc welders has been extended to include the 400-amp model built by Lincoln Electric Co, 12818 Coit Rd, Cleveland Ohio This advance makes available easy starting in any weather and permits inherent economies of diesel drive in the various applications for engine driven welders in the larger capacities

Gasoline starting is effected by a

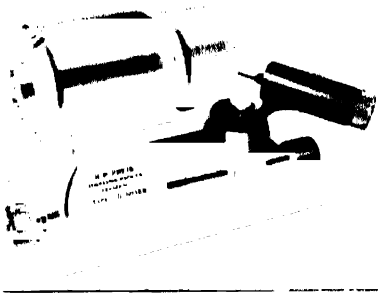


small auxiliary engine mounted above the diesel, which is started by means of a hand crank A belt drive, engaged by means of a clutch, connects the starting engine to the diesel Starting in extremely cold weather is facilitated by having the cooling system of the small starting engine connected with that of the diesel This permits warming up the diesel by running the starting engine a short time and allowing the heated water to circulate through the diesel jacket

Small Bench Grinder Sharpens Single Lip Routing Cutters

A compact bench-type grinder for accurate sharpening of single-lip engraving and routing cutters has been developed by H P Preis Engraving Machine Co, 157 Summit St, Newark, N J This machine, known as "Panto" Model CG, handles tapered-shank cutters and straight-shank cutters up to $\frac{1}{4}$ in in diameter

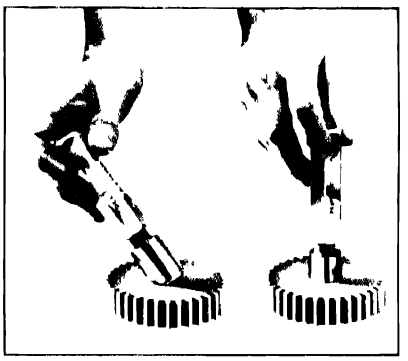
Grinding wheel is of the cup type $2\frac{1}{4}$ in in diameter, and is attached directly to the shaft of a totally inclosed ball bearing universal motor operating at 8,500 r p m Cutter-holding spindle is mounted in a swivel arm which is graduated for quick setting to any cutting angle or taper Stop notches are provided for grinding three-cornered or four-cornered cutters While the cutter is rotated with the operator's right hand, the carriage is fed to the grinding wheel by means of a feed screw actuated with the left hand



Unit is $9\frac{1}{2}$ in long, $4\frac{1}{2}$ in wide and 6 in high Weight is 13 lb A solid spindle is furnished for users of tapered-shank cutters only and a collet spindle is available for those using both tapered-shank and straight-shank types

P&W "Pilot" Plug Gage Enters Holes Easily

Pratt & Whitney Div of Niles-Bement-Pond Co, West Hartford Conn has made available a line of "Pilot" plug gages which are easily inserted in holes Instead of being difficult to

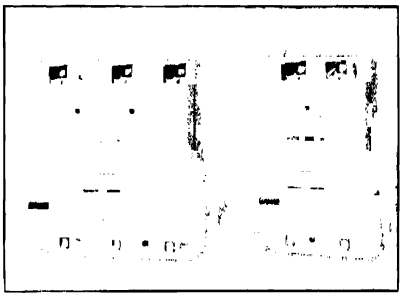


start, this plug gage can be presented lightly at an angle and almost falls in by itself The combination of a chamfer at the end and the angular groove near the end permits easy entry, and the gage centralizes itself, lines up and enters without jamming Even when the plug is a very close fit it slides in without difficulty

In addition to the time saved by speeding up the actual gaging operation the "Pilot" saves additional time since it will not jam, thereby causing possible damage both to the work and to itself

General Purpose Circuit Breakers Have Adjustable Trip Setting

A line of Type AB general utility circuit breakers for inclosure, panelboard or switchboard mounting featuring an adjustable trip setting has



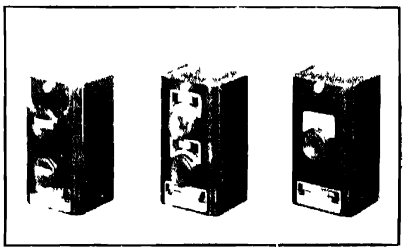
been made available by Westinghouse Electric & Mfg Co, East Pittsburgh, Pa These breakers, rated at 50, 70, 90 and 100 amp at 250 and 600 volts a c 2 and 3 pole and at 125 and 250 volts d c, are especially adaptable to lighting and feeder circuits and to motor branch circuit protection

All breakers use the 100-amp frame, permitting physical interchangeability The adjustable magnetic trip permits very close setting of the breaker for any tripping current from $3\frac{1}{2}$ to 11 times the breaker's normal rated current and enables the trip to be set in the field under actual service conditions to give maximum protection to the equipment An inverse time thermal trip of the bi-metallic type provides adequate protection for light overloads Improvements over the older series include use of a hot molded base and cover, a replaceable molded operating handle, and an external trip rating marker located in plain view on the breaker cover The moving contact arm has also been redesigned to require minimum flexing of the shunt insuring longer life

Standard Duty Pushbutton Stations Announced by General Electric

A line of general purpose one and two button standard duty pushbutton stations announced by General Electric Co, Schenectady N Y, offers improvements in operation appearance, and ease of installation Having $\frac{7}{8}$ in molded buttons, they are similar in appearance to the G E heavy duty stations

Buttons are protected from acci-

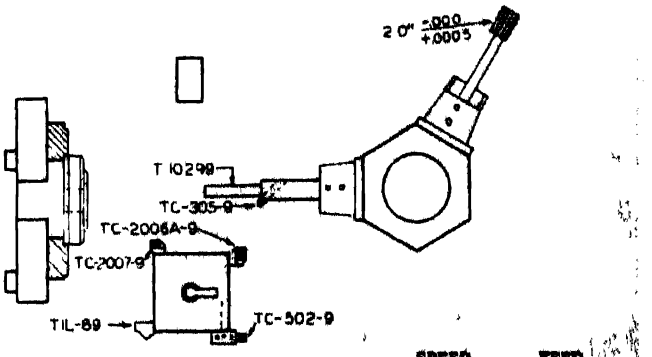


dental operation by guard rings The words "Start" and "Stop" molded into the buttons are filled with white paint to make them easily readable. Further identification can be provided on separate plates attached to the inclosure above the buttons

Inclosures measure $4\frac{9}{16}$ in. high,



How To Cut Steel with CARBIDE TOOLS



OPERATIONS (Gishalt Turret Lathe used)	Tool Number*	SPEED R.P.M.	SPEED F.P.M.	FEED T. Post	FEED Per.
Bore for ream, 1 cut	TC-305-9	149	78		.011
Turn O D for hobbing, 1 cut	TC-2007-9	149	234	.011	
Face gear and shoulder, 1 cut	TC-2006A-9	149	234	.011	
Co-bore, 1 cut	TC-502-9	149	98	.011	
Ream 2.000"		109	57		.036
Chamfer gear edge and burr	T-1L-89	109	171	Hd.	

("TC" = Carboloy)

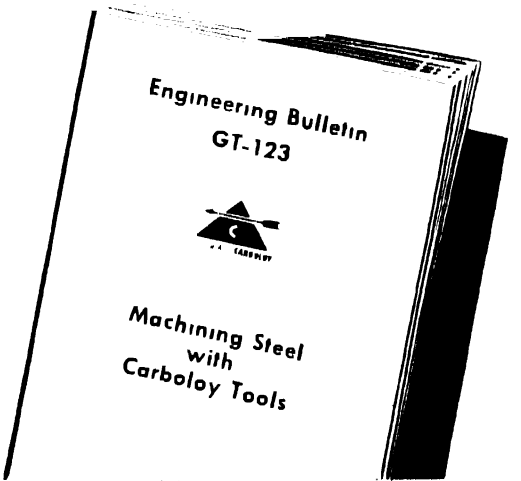
One of more than 1000 Carboloy tool applications at Gisholt Machine Co. — 80% of which are steel cutting.

Production men now preparing for the large production increase to come when the full force of the defense program reaches industry, will find much information of *IMMEDIATE* value in the NEW engineering bulletin, "Machining Steel with Carboloy Tools."

It describes how to provide best machine conditions for machining steel with carbides, gives you recommended tool rakes; most efficient chip breakers and a simple way to duplicate them. Helps you to select correct speeds and feeds for all types of steel. Describes use of coolants, and takes the "guess-work" out of carbide grade selection.

This new bulletin GT-123 will be sent to you free upon request

A New 12-Page Manual — Free upon request



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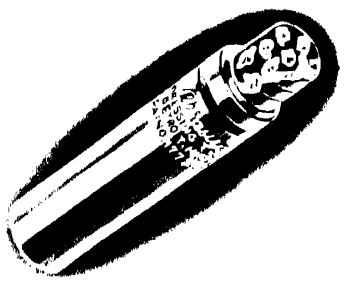
TANTALUM CARBIDES
TITANIUM CARBIDES
TUNGSTEN CARBIDES

2⅝ in. wide, and 2½ in. deep. They are made entirely of steel, consisting of a back and cover. Cover is crimped over at the ends to overlap the top and bottom ends of the back, and is held in place by screws at top and bottom. Mounting holes are conveniently located.

Improved Diamond Tools Offered by Abrasive

Abrasive Dressing Tool Co., 1550 Broadway, Detroit, Mich., has begun production of an improved line of diamond tools known as the "Red Band" series, positively identified with a brilliant red band on the shank. In addition to the "Oxide-Free" process which secures the diamond in the tool, other exclusive production methods have been adopted to promote economy and long life.

The No. 11 diamond tool is de-



signed for versatility. It contains three rows of diamonds, precisely staggered and spaced to permit the tools to be used for single-stone dressing, or for cluster-type dressing. By regulating the drag-angle, a single stone or three stones may make contact with the wheel. It contains 11 diamonds, weighing approximately 1.25 karats.

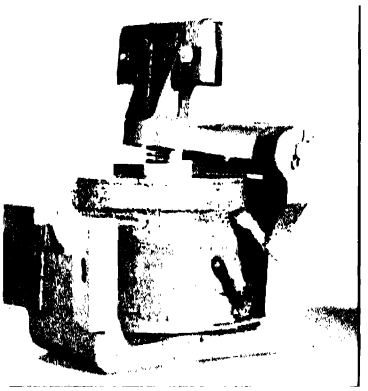
Cowles Aluminum Cleaner Developed to Prevent Corrosion

A general cleaner for aluminum parts of all kinds has been added to the line of metal cleaners manufactured by Cowles Detergent Co., 7016 Euclid Ave., Cleveland, Ohio. Identified as Cowles AE, this mildly alkaline cleaner has been especially developed to prevent corrosion of nonferrous metals.

Mirror-finished surfaces of aluminum are said not to be visibly affected by an hour's exposure to concentrations of this cleaner as high as six ounces per gallon at boiling. AE cleaner has been compounded to produce in solution the high colloidal activity and proper balance of detergent anions necessary for the efficient and safe cleaning of aluminum parts from accumulations of shop dirt and drawing and cutting oils. It is customarily used in concentrations of three to six ounces per gallon of hot water. Parts rinse freely and after drying are ready for further finishing or assembly.

Magnetic Brake Holds Gearless Cable Reels

A magnetic brake for use on open type vertical axis gearless cable reels to prevent the cable from unwinding due to power failure has been made available by Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa. Brake is rigidly mounted on the reel motor



frame in such position that the brake shoe contour is adjacent to the inside of the reel drum. As long as power is applied to the reel, a magnetic holding coil in the brake holds the shoe away from the drum. When power fails, the coil is de-energized and the brake shoe is projected, by means of a spring, against the drum. This immediate stopping prevents the cable from unwinding and snarling.

Electric Remote Control Available for "Varidrives"

U. S. Electrical Motors, Inc., Dept. 23, 80 34th St., Brooklyn, N. Y., has developed a system of electric remote control for the U.S. "Varidrive" motor. This system makes possible automatic control of the take-off shaft speed by means of a thermostat, float switch or other control.

The control consists of a small worm gear reducer mounted on the "Varidrive" control case and connected to the control shaft which



changes the speed. The pilot motor is operated by a thermostat, float switch or similar control through a cyclic relay or process timer. The thermostat or float switch controls the direction of speed change, while the cyclic relay governs the rate of change.

Guth Fluorescent Fixtures Make Maintenance Easy

A fluorescent lighting fixture developed to provide better maintenance as well as efficient light control has been made available by the Edwin F. Guth Co., 2615 Washington Ave., St. Louis, Mo. Known as the Utility "Flu-O-Flector," this unit provides a separate inner reflector and a protective steel housing, the reflector being removed by unscrewing two large knurled nuts. With extra reflectors at hand, maintenance crews simply take down the dirty reflectors and substitute clean ones. Time is saved, the cleaning operation is safer, and a much better cleaning job is achieved.

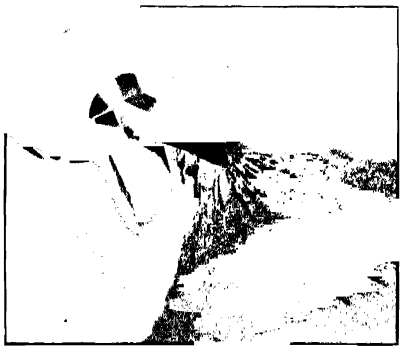
Reflector is made of aluminum finished by the Alzak process. Outer housing is of heavy gage steel which is rust-protected. High power factor lamp control and accessible starter switches are secured in the housing, leaving the reflector free for better maintenance.

NEW MATERIALS

Jessop Free Machining Steel Has Non-Magnetic Properties

A non-magnetic free machining alloy steel possessing low magnetic permeability with superior mechanical properties has been developed especially for the electrical industry by Jessop Steel Co., 595 Green St., Washington, Pa. Another desirable property of this steel is its high electrical resistance, which considerably reduces eddy current losses.

Shown in the illustration is a piece



of electrically magnetized iron at the right and a piece of Jessop non-magnetic steel at the left. Note that the lines of force (shown in iron filings) are all directed to the iron sample at the right. In the annealed condition, this steel has a tensile strength

of 80,000 to 110,000 lb per sq in, a yield point of 35,000 to 60,000 lb per sq in, 2-in elongation of 25–50 per cent reduction of area of 30–60 per cent and Izod impact value at room temperature of 80 ft-lb

It is claimed that this non-magnetic steel can readily be formed welded, machined and blanked It can be used in transformer controller switch covers entrance plates spacing bars and fingers and numerous other parts of electrical equipment

Practical Molds for Plastics

An interchange of illustrations in the article "Practical Molds for Plastics (*AM*—Vol 84, page 489) has been called to our attention by Mr Lehmann, author of the article The drawing shown on page 489 should appear with the caption for Fig 3 on page 490, while the illustration now shown with this caption should be shown on page 489 with the caption for Fig 1

TRADE PUBLICATIONS

ACCESSORIES The Allen Manufacturing Co Hartford Conn has just published a listing of die makers accessories in Pamphlet 119

ALLOY STEEL Jessop Steel Co Washington Pa discusses in an 8-page folder the applications of 'Truform' oil-hardening non-shrinkable alloy tool steels

ARC WELDING ELECTRODES Booklet No ADW-18 issued by Wilson Welder & Metal Co Inc, 60 E 42nd St, New York, N Y contains 24 pages illustrating arc welding electrodes

BEARINGS A 76-page catalog No 400 circulated by Johnson Bronze Co New Castle, Pa offers a progressive size listing of bearings

BEARINGS The Bunting Brass & Bronze Co, Toledo Ohio has issued a general catalog of bearings available from stock

BEARINGS A 112-page booklet discussing the factors to be considered in the selection of anti-friction bearings is offered by New Departure Division General Motors Corp, Bristol, Conn.

CARBON TOOL STEELS Allegheny Ludlum Steel Corp, Pittsburgh, Pa has just published a folder on the subject of Straight Carbon Tool Steels

CENTRIFUGALS Three booklets have been issued by the Tolhurst Centrifugal Div of the American Machine & Metals, Inc, 100 Sixth

Advertisement

New Alloy Steel Has Longer Life For Heavy Duty Applications

Many machine shops report favorable results with SAE 1815 a carburizing nickel molybdenum alloy steel for heavy duty gear and shafting applications

An outstanding advantage of SAE 1815 is the high core strength which may be developed by the single quench treatment In sections up to 1 tensile values up to 200,000 psi and yield strengths in the neighborhood of 165,000 psi may be developed in the core together with hardnesses up to 415 BHN providing excellent backing for the case under crushing loads The tough fine grained case which is readily developed provides exceptional resistance to wear spalling and pitting fatigue making SAE 1815 optional suited for highly ssed parts such s gear pinions adles splined transmission butts u

In it normalized condition cutting speeds and finish compare with SAE 1615 and SAE 2515

SAE 1815 is carried in tock by Joseph T Ryerson & Son Inc in hot rolled rounds in diameters ranging from ½" to 6" inclusive For further information write the nearest Ryerson plant (see advertisement below)

Steel for Defense . . .



is ready at RYERSON

Over the wires to ten great Ryerson plants comes ever growing demands for steel to meet the strict requirements of America's defense program Industry knows from 98 years of experience that Ryerson is a strong first line of support when good steel is needed quickly

It's a matter of *seconds* from your plant to the Ryerson order department A matter of *record* for you to tell Ryerson just what you want And a matter of *record* for your order to be on its way in the Ryerson lightning fast order handling system that gets steel shipped the day it's ordered

Bars plates sheets, shapes beams stainless steels and alloys 10,000 different kinds sizes and shapes all in tock for instant service! And all Ryerson Certified quality your positive insurance against shop losses due to faulty steel Ryerson Certified Steels are closely controlled as to chemical content accuracy and finish without the slightest increase in cost to you

If you don't know Ryerson reliability and if you're working on defense orders or other RUSH business and you need steel Get in touch with Ryerson today!

Write for Stock List

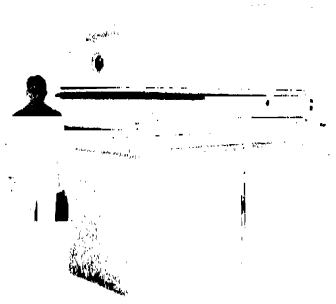
Joseph T Ryerson & Son, Inc, Chicago, Milwaukee, St Louis, Cincinnati, Detroit, Cleveland, Buffalo, Boston, Philadelphia, Jersey City

RYERSON CERTIFIED STEELS

RYERSON

SPEED UP YOUR WELDING OF HIGH STRENGTH LOW ALLOYS WITH

ELECTRODES



SPECIALLY DESIGNED FOR CARBON-MOLY, COR-TEN, MAYARI, CROMANSIL, 2%-3% NICKEL AND OTHER STEELS

The Murex line includes a group of specially developed rods designed to produce welds with tensile strengths ranging from 70,000 to 100,000 lbs per sq in, ductilities of 20% to 30% and corrosion and heat resisting qualities matching closely any of the more widely used new steels Because of their excellent deposition rates at high amperages, their ease of handling by skilled welders, and the assurance they provide of cleaner, smoother deposits they step up welding speeds and help hold down costs.

Ask to have Murex Electrodes demonstrated on your high strength—low alloy applications A note to the nearest M & T office will bring a representative promptly

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A COMPLETE LINE FOR EVERY WELDING APPLICATION

Investigate Thermit Welding too—in use since 1902 for heavy repair work, crankshafts housings frames, etc

Ave, New York, N. Y which describe the application of centrifugal force to the drying, enameling and galvanizing of metal products

DOUBLE STRENGTH STEEL A 40-page illustrated catalog No 353 circulated by Republic Steel Corp, Cleveland, Ohio, discusses the development and application of double-strength steel

DUST CONTROL Bulletin No 270 circulated by American Air Filter Co, Inc, Louisville, Ky provides information regarding "Roto-clone" dust control

DYNAMOMETERS A 4-page illustrated folder No GEA-2924 describing inductor type dynamometers is being circulated by General Electric, Schenectady, N Y

ELECTRODES A 12-page illustrated booklet No 26-645 offered by Westinghouse Electric & Mfg Co, East Pittsburgh, Pa, describes a c and d c "Crucible-Weld" Flexarc welding electrodes

END MILLS A 4-page pamphlet No 109, issued by Goddard & Goddard Co, Inc, Detroit, Mich, illustrates the construction and operation of "Spi-Rate" end mills

GEAR CHECKING National Broach & Machine Co, Shoemaker and St Jean, Detroit, Mich has published an eight-page pamphlet which discusses the testing of gears for noise

GEARED DRIVES A 34-page illustrated booklet, issued by Westinghouse Electric & Mfg Co East Pittsburgh, Pa, describes the features of geared drives.

GEARS Brad Foote Gear Works 1301 So Cicero Ave, Cicero Ill notes prices of all sizes of stock gears in its 1940 Catalog No 110

GRINDING "The Use of Abrasives for Removing and Finishing Metals is the title of a four-page bulletin Form No G-455, recently published by Cincinnati Milling Machine and Cincinnati Grinders, Inc Cincinnati, Ohio This bulletin was prepared by George Binns and discusses the factors affecting grinding operations on various types of machines The bulletin should be interesting and helpful to those executives in charge of grinding machine operators and apprentices

LEATHER LINK BELTS Booklet No A-13 circulated by Alexander Bros, 406 North Third St, Philadelphia, Pa illustrates the application of duplex leather link belts

LEATHER PACKINGS A 20-page catalog issued by E F Houghton & Co, Third, American and Somerset Sts, Philadelphia, Pa. discusses the application of leather packings.

MATERIALS HANDLING Catalog No. 21 circulated by Lewis-Shepard Sales Corp, 295 Walnut St., Watertown, Mass, describes 175 items of their line of materials handling equipment

PLANER DRIVES An 8-page booklet No B-2214 circulated by Westinghouse Electric & Mfg Co, East Pittsburgh, Pa, describes variable voltage planer drives

POWER SQUARING SHEARS Niagara Machine & Tool Works, 637-697 Northland Ave, Buffalo, N Y illustrates and discusses power squaring shears in 23-page bulletin No 72-A

PRESS BRAKES The Cincinnati Shaper Co, Cincinnati, Ohio, describes the construction design and operation of press brakes in a new bulletin

RELAY Leaflet No GEA-2902B circulated by General Electric Co Schenectady, N Y offers illustrated information regarding a vacuum-tube timer

RESINS A booklet which describes the fabrication of resins by common woodworking and metal working methods, has just been issued by Union Carbide & Carbon Corp 30 E 42nd St, New York, N Y

ROLL GRINDERS A 12-page booklet circulated by Mesta Machine Co Pittsburgh, Pa describes the construction and performance of roll grinders

SAFETY SWITCHES Westinghouse Electric & Mfg Co, East Pittsburgh Pa, describes in leaflet No 29-550 its safety switches for industrial and general purpose application

SHAPERS Illustrated catalog No 1 offered by the Cincinnati Shaper Co Cincinnati, Ohio, describes their rapid traverse high speed shapers

SMALL TOOLS Catalog No 8 circulated by the Weldon Tool Co, Cleveland, Ohio, contains a 73-page listing of all its stock tools

SPRAY GUNS A four-page folder circulated by Master Metal Spray, Inc, 2527 Magnolia St, Oakland, Calif., discusses the operation of metal spray guns and moisture separators

SPRAY PAINTING EQUIPMENT The DeVilbiss Co, Toledo, Ohio, has just published a handbook titled, "The A B C of Spray Painting Equipment"

TUBE EQUIPMENT Bulletin No 40E issued by The Parker Appliance Co, 17325 Euclid Ave, Cleveland, Ohio, contains instructions and a price list concerning tube bending equipment.

TURRET LATHES Circulated by Gisholt Machine Co, Madison, Wis is a new 40-page booklet which describes standard tools for turret lathes

V-BELT DRIVES A new V-belt guide, form No 325, has been issued by L H Gilmer Co, Tacony, Philadelphia, Pa

WELDING ACCESSORIES Mine Safety Appliances Co Braddock Thomas & Meade Sts, Pittsburgh Pa, illustrates a new one-piece model welding helmet and accessories in a four-page folder

NEW BOOKS

PRINCIPLES OF MECHANISM *Third Edition—By F Dyson lecturer in mechanical engineering, City and Guild (Engineering) College Imperial College of Science and Technology, London 363 pages Oxford University Press, 114 Fifth Ave New York $4.25*

The theory of machines rather than the practical application of machine design is the object of this volume While it is recognized that the student and the graduate engineer often find gaps between theoretical concepts and the technique of putting them into practice this ground has been thoroughly covered by many volumes on machine design

The third edition follows the same general arrangement as those which preceded it but has two new sections on advanced work New material includes data on planetary gearing pre-selective gear boxes acceleration of a piston, mathematical analysis of a follower in contact with a cam face and acceleration diagram for a quick return motion

Examples are provided for practically all the points covered

FABRICATION OF U S S STAINLESS STEELS—*Prepared by United States Steel Corporation Subsidiaries 92 pages Published by Carnegie-Illinois Steel Corp Pittsburgh, Pa $1*

This practical book, which discusses the welding, riveting, soldering machining cutting, forming, annealing, pickling, surface finishing and protection of the various U S S stainless steels, is divided into three comprehensive sections The technical and practical aspects of stainless steel fabrications are discussed in detail Austenetic, ferritic and martensitic stainless steels are treated separately and in detail

Part I is devoted to welding, riveting, soldering and joint design, and includes a series of diagrams illustrating the various joints commonly used in fabricating stainless steel The application of these joints are discussed in detail and their efficient use is described Part II takes up machining, cutting, forming anneal-

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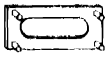
1441

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ing and pickling operations. Recommendations as to equipment, temperatures, solutions, etc., are presented. Surface finishing and protection are discussed in Part III. Standard mill finishes are described and the operations and equipment involved in developing desired finishes are covered in detail. Laboratory corrosion data covering a wide range of chemicals and acids are presented for four types of stainless steels and the chemical, physical and mechanical properties, with notations as to abrasion resistance, cold forming and welding, are tabulated for nine types of stainless steels. Copies of this book may be secured from the offices of the Carnegie-Illinois Steel Corporation, American Steel & Wire Co., Columbia Steel Co. or the National Tube Co.

PRODUCTION MANAGEMENT—*Written by A. M. Simons and reviewed by Henry Post Dutton. 588 pages. Published by American Technical Society, Chicago, Ill. $3.50.*

Production problems today are so complex and demands upon management are so varied that successful industry must employ the highest grade of professional ability. The profession of industrial management rapidly is being filled by men who have supplemented personal experience with organized education. This book has been prepared to aid the student of industrial management in solving production problems.

Written primarily for the student, and not too technical in its language, this volume covers practically all of the phases of production management in easily understood language.

MACHINE DESIGN DRAWING ROOM PROBLEMS—*By C. D. Albert, Professor of Machine Design, Cornell University. 441 pages. Published by John Wiley & Sons, Inc., 440 Fourth Ave., New York, N. Y. $3.50.*

In this third edition of "Machine Design Drawing Room Problems" five of the seven design problems of the second edition have been retained and revised, the three reference chapters of the second edition have been expanded to six chapters and almost entirely rewritten, and eight new problems and four new reference chapters have been added. The arrangement of the chapters also has been changed. The first fourteen chapters consist of an introductory chapter followed by thirteen chapters, each of which is devoted to a design problem. The last nine chapters are reference chapters so arranged that the major part of the information in tabular form is in the last two chapters of the book. The design problems are arranged practically in the order of their length and the time required for their solution. The notation has been changed throughout to agree with that used in the more recent books on mechanics and strength of materials, and also to agree, so far as possible, with the recommendations of the American Standards Association.

Full use of drawings and photographs is made throughout the text, with tabulated data being used wherever necessary. Each problem deals with a specific piece of apparatus in common use and is designed to bring out certain specific factors in machine design. The author presupposes a knowledge of kinematics, mechanics and engineering drawing and offers in this book complete material for a drawing room course in general machine design. The author assumes that a separate recitation course is to be given based upon some standard text on general machine design.

INDUCTION MOTORS—*By S. Gordon Monk, head of Electrical Engineering Department, Plymouth and Davenport Technical College. 146 pages. Distributed by The Chemical Publishing Co., Inc., 148 Lafayette St., New York, N. Y. $2.*

Published in England, this clothbound volume, according to the author, is intended as a general survey of the properties and applications of induction motors. It is not intended to be exhaustive, and the design part of the subject has only been lightly touched upon. The fundamental principles and properties of induction motors have been the main concern of the author. Examples for student use are given at the end of each chapter. Answers to these examples are listed in the back of the book.

TO THE EDITOR

Why Not Summer-School Training?

Dear Sir:

Your editorial, "Bewildered, Not Lost!", interests me very much, and has led to the following comments:

Granted that it takes some years to make a skilled craftsman, nevertheless it has been demonstrated that high-school graduates, carefully chosen for intelligence and mechanical aptitude, can be taught in a short time to perform efficiently many types of work in the skilled classifications, if they are given adequate instructions at each step, followed by close and continued supervision.

In many of our industrial centers, the public vocational high schools close their doors about the first of June, leaving idle for three months equipment worth hundreds of dollars. Is there any good reason why industry could not select and send young men to these institutions for an in-

tensive course of instruction during this three-month period? Cannot promising young men with some experience be sent to these schools at night to further their knowledge, skill and experience?

True, the number trained in this manner would be small; but at least we would have a few more workers who had been properly trained in the operation of machine tools, and a few more who had a start toward the higher skills. Here at least is a potential source which should be investigated, and it is time the fields of industry and education were brought closer together.

Another thought: In many plants there may be equipment in the tool room or maintenance departments which is not being used 24 hours a day. Is there any good reason why at least some of this equipment could not be used for training during the second or even third shift?

This, of course, brings up the problem of obtaining instructors; but if this problem is analyzed we find that by selecting the right men, a short course in training would teach them the fundamentals of imparting their knowledge to the other fellow.

The success of such programs would depend on three points: first, the selection of the young men; second, enough instructors to provide adequate instruction followed by continuous supervision; third, work produced, tools used and working conditions should approach as near as possible the actual conditions found in industry.

Quite naturally production is one of the first thoughts of management; but production depends on workers, and perhaps management needs to give first place, for the moment, to training future skilled craftsmen.

It is a tough problem, but it can be licked if enough thought is given to the job now, before we find a real emergency on our hands.

Yours very truly,
CARROLL JOHN GROOM
Director Vocational Training
The Hoover Company
North Canton, Ohio

The Pen Is Mightier . . .

Dear Sir:

Your editorials are as important as the excellent data inclosed and as the fine, modern equipment you advertise. The coordination of the machine to meet our human needs is worthy of substantiation. Your editorials can do this.

I want you to know my father was a reader of AMERICAN MACHINIST when it was just a twinkle in the printing presses' eye. Through his influence the sons learned to read it too, and that's just the point—a periodical as well organized and written in language which all laymen can understand should be in the hands of the youth with a love for things mechanical. The thrill of self-education and accomplishment can go a long way toward the solution of our present and future problems. You are doing good work—keep it up.

Sincerely yours,
H. M. BRIGHTMAN
Assistant to President
Columbia Steel & Shafting Company
Pittsburgh, Pa.

SEEN and HEARD

JOHN R. GODFREY

Skull Cracker Tups

Skull cracker heads, or "tups", are usually of cast iron or steel. But one scrap yard at least uses pieces of steel that once did duty as parts of the main shafts of steam engines that have gone the way of other obsolete machinery. There are several sizes of these tups in use by the Alamo Iron Works in San Antonio, Texas, and are selected according to the size and character of the scrap to be broken up. They also use several sizes of cast tups. The wear or damage to these tups is more rapid than might be imagined and replacement is frequently necessary.

Taxes by the Hour

The Old Man was walking through the shop one day when one of his best lathe hands, Sam, said, "I've been reading a lot about the high taxes that everybody is supposed to be paying in this country and I was just wondering how much our company pays to the government."

"Well, I don't know exactly Sam, but I think we pay about one quarter of a million dollars a year," said the Old Man. "I'll look it up for you and give you more exact figures tomorrow."

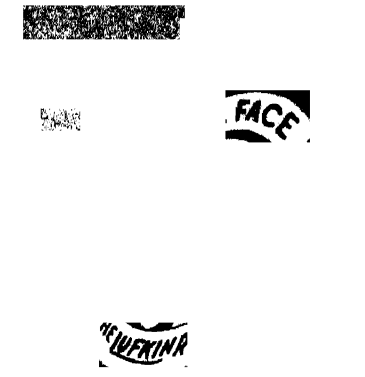
The next day he told Sam that the actual amount of taxes paid last year by the company had been 23 cents for every hour worked by each employee.

"You mean to tell me that for every hour you pay me the government gets 23 cents? If that is the case we ought to do something about it."

Low Powered Shop

One of the best ways of realizing the small amount of power used in machine shops 50 years ago, is to use the automobile as a yardstick. It was common for a three or four story shop, employing from 50 to 60 men, to be driven by a 25-hp. engine, usually in the basement. How much of this power was used up in belts and line shafting is anybody's guess. Now the cars the men drive to work have over three times this power under the hood.



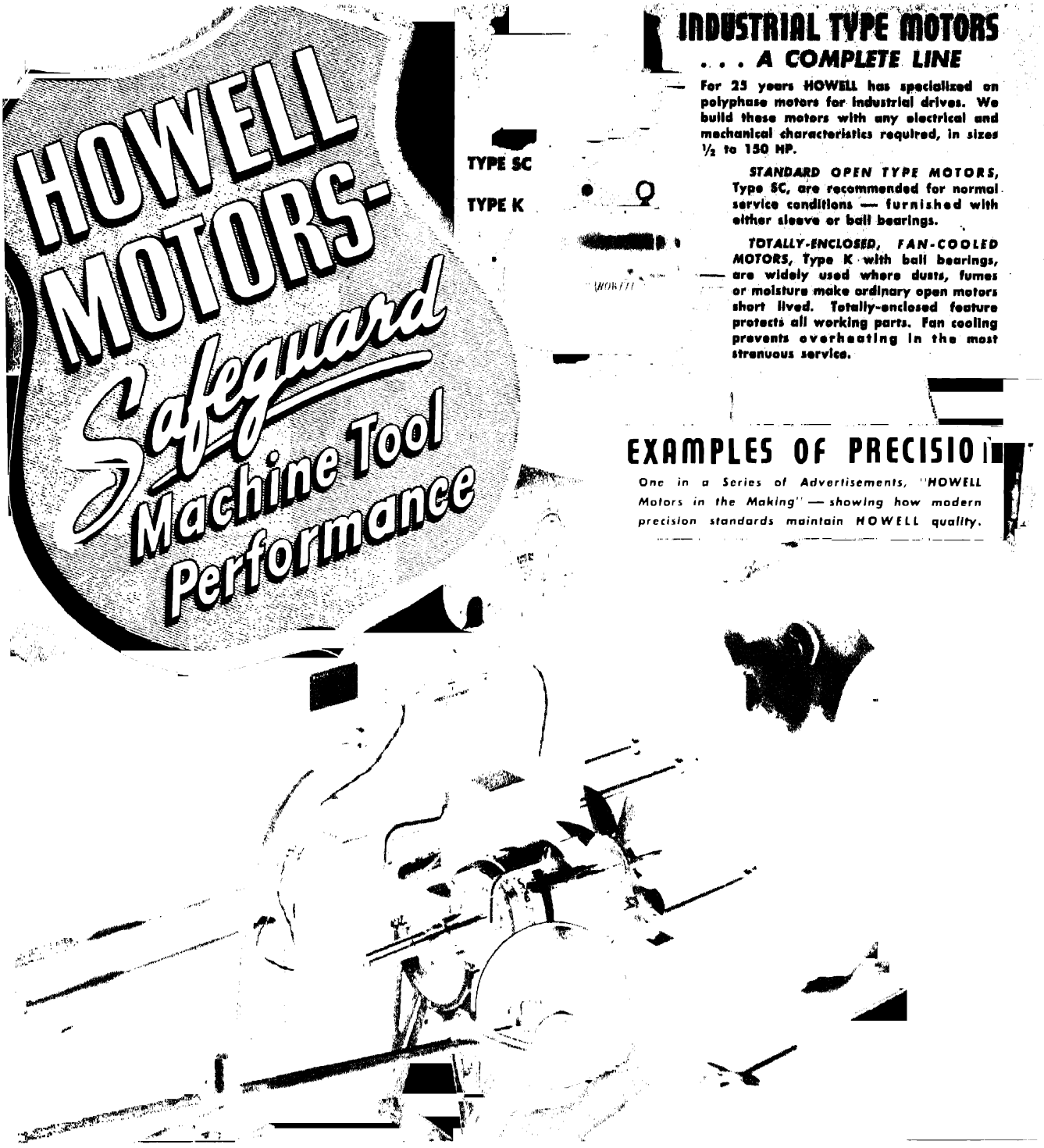








HOWELL MOTORS—Safeguard Machine Tool Performance



INDUSTRIAL TYPE MOTORS
. . . A COMPLETE LINE

For 25 years HOWELL has specialized on polyphase motors for industrial drives. We build these motors with any electrical and mechanical characteristics required, in sizes ½ to 150 HP.

STANDARD OPEN TYPE MOTORS, **Type SC, are recommended for normal service conditions — furnished with either sleeve or ball bearings.**

TOTALLY-ENCLOSED, FAN-COOLED MOTORS, **Type K with ball bearings, are widely used where dusts, fumes or moisture make ordinary open motors short lived. Totally-enclosed feature protects all working parts. Fan cooling prevents overheating in the most strenuous service.**

EXAMPLES OF PRECISION

One in a Series of Advertisements, "HOWELL Motors in the Making" — showing how modern precision standards maintain HOWELL quality.

Here's Our PRECISION METHOD of Eliminating Destructive Vibration

A static balance of the rotor is not good enough at HOWELL! We subject every rotor assembly to a DYNAMIC BALANCE TEST, using the most sensitive testing equipment obtainable. Testing procedure is shown above. Each rotor assembly is operated at approximately the rated speed of the completed motor — the stroboglow lamp showing exact location of unbalance — the electronically operated meter indicating amount of unbalance. Correction for balance is made possible by this accurate information.

The precision-balanced HOWELL rotor assembly SAFEGUARDS your machine tool performance by eliminating drive vibration. It also insures longer motor bearing life.

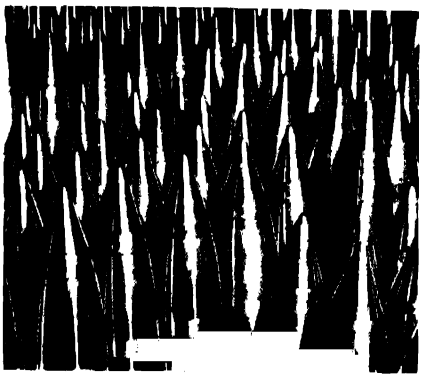
Fast Delivery!

Your motor requirements—are they standard or special? Whatever your needs, the HOWELL organization is sufficiently flexible to meet them EXACTLY, and on time. Write us today, outlining your particular drive problem!

HOWELL ELECTRIC MOTORS COMPANY

AMERICAN MACHINIST

September 4, 1940



Army photo

Insurance *Plenty of shell and guns to fire them may prove the best peace insurance*

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PRINTED IN U.S.A.

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American Machinist

Announces Its

ANNUAL METAL SHOW NUMBER

October 16, 1940, featuring

1. **SHOW-IN-PRINT:** Descriptions of new equipment to be displayed for the first time at the Metal Show in Cleveland, October 21-24.

2. **WORKING OF COLD-ROLLED, SHEET CARBON STEEL:** Ninth in American Machinist's series of special sections on the Working of Materials—including detailed data on punching, drilling, forming, welding, annealing, preparation for finishing, etc.

3. **APPLICATIONS OF HEAT-TREATING IN MUNITIONS MANUFACTURE.** What's new in heating and heat-treating—practical hints applicable to many jobs.

4. **APPLICATIONS OF WELDING IN MUNITIONS MANUFACTURE.** A special picture-caption story of latest adaptations.

WHAT'S IN THIS ISSUE

OLD GRINDS

are not so good for new type cutters especially those tipped with carbide Half the secret of the phenomenal performance of carbide tools lies in precise control of the cutting edge angles In his second article on grinding carbide cutters Fred W Lucht of Carboloy tells how to save both time and money by eliminating cut and try methods His advice is on page 658

FOR DEFENSE

America's defense needs can be summed up in three words men machines munitions Methods of converting an adequate amount of the country's vast manpower into an effective military force are duly being debated in legislative chambers in offices in almost every home throughout the land The greatly more complicated problem of machines both machine of war and machines to make those machines is being thrashed out by military experts and industrial authorities And munitions manufacture is not only being rushed but the technique is being streamlined as well Shops the country over are urged to familiarize themselves with problems of material production To this aim the section beginning on page 667 is dedicated

This section is known as the Armament Section of AMERICAN MACHINIST Scheduled to appear in virtually every issue until the present defense crisis is past this section will give tangible specific details as to how *you* can manufacture various items of military importance The first section for instance tells *how to make* 75 mm shells not just how an arsenal makes them It is no condensed outline either but contains twelve pages jammed with recommendations and details of the tooling involved Though the methods described were worked out at Frankford Arsenal they can be applied by any one making this type of shell

INGENIOUS

Production of training plane engines is quadrupled by the use of ingenious tooling set ups We quote from page 653 Doubling tripling quadrupling aircraft engine production is no news these days But when it's done without appreciable expansion of plant facilities that's news If a plane engine maker can do it so



WALTER MILKA

production manager of Kinner Motors whose aircraft engine production was quadrupled with little more than ingenious tooling set ups

can anyone else Anyone else that is who's swinging from small lot operation to considerably greater production Making the changeover involves a few headaches but nothing that intelligent planning (and maybe a little Alka Seltzer) won't cure Walter Milka production manager of Kinner Motors the company under discussion is in a position to offer considerable concrete advice on the subject In Fixtures Step Up Output he does just that

GOOD INDICATION

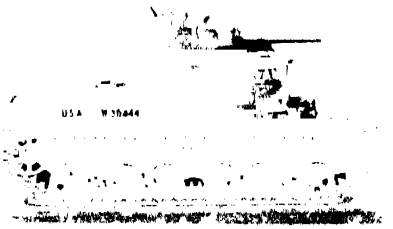
If by now you haven't become engrossed in C C Street's series on measurement for production it's high time you were digging out those back issues and catching up For AMERICAN MACHINIST publishes no synopses of preceding chapters This issue's installment which begins on page 656 to our mind is packed with some of the most useful information so far It discusses the construction and operation of dial indicators including an analysis of theoretical errors and practical compensations Which is all to the good when it comes to getting maximum accuracy out of those useful little indicators which are duly becoming still more useful

PHOTOPHILE

Which in accordance with Webster might mean a lover of photographs Or if you're in your best punning form a collection of photographs In either case you may possibly be thankful that that was the title we rejected in favor of Shop Shots a department relatively new to these pages Like Short Cuts for the Small Shop which have become so popular Shop Shots will appear every now and then to round out our editorial content will depict various time money and temper saving devices worked out in all kinds of plants large and small On page 662 we present the second batch

COMING

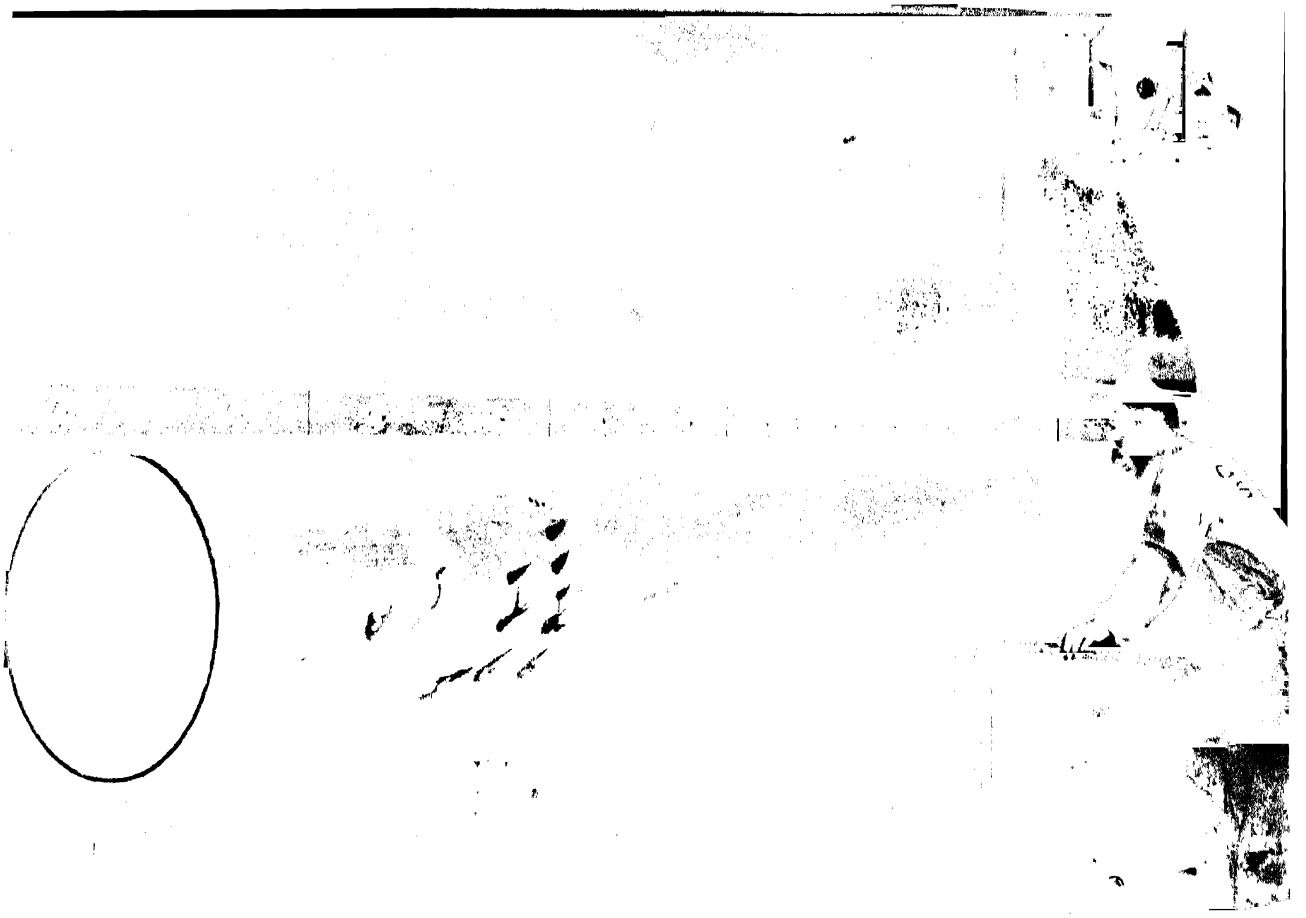
Tanks by the ton have played an important part in World War II What is the United States doing in the way of tank development? Well Rock Island Arsenal for instance at present is producing combat cars and medium tanks which after minor bugs have been ironed out will probably be built in private plants also What are these tanks like? How are they made? What are some of the



M 2

is the Army's official designation for this medium tank which is now being produced at the Rock Island Arsenal How it's made will be detailed in the next Armament Section of American Machinist scheduled for September 18

production problems? These and other vital questions will soon be answered in a forthcoming article on tank manufacture Look for it in an early issue of AMERICAN MACHINIST



Pipes . . . Tubes . . . Posts

. . . are easily and accurately formed on Cincinnati Press Brakes.

Cincinnati Press Brakes are also used for crimping sheet and plate before rolling to eliminate flats at seam edges of rolled shapes.

Write for recommendations on your job.





THE CINCINNATI SHAPER COMPANY, CINCINNATI, OHIO

SHAPERS SHEARS BRAKES

Fixtures step up output

BY WALTER MILKA PRODUCTION MANAGER KINNER MOTORS INCORPORATED

Production of training plane engines is quadrupled by the use of some ingenious tooling

IN THE MIDST of an expanding domestic business Kinner Motors Incorporated was suddenly favored with a substantial order for engines to be used by Canada in the Empire pilot training plan Practically overnight the company had to boost production from less than one engine a day to more than 100 a month and it is now striving for 250

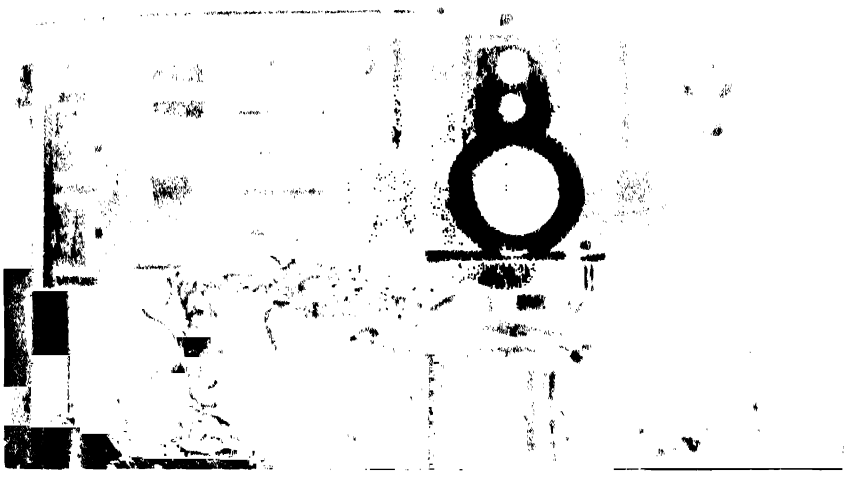
This increase has not been accomplished by a vast expansion of plant facilities but rather by the design of clever fixtures which salvage much time ordinarily lost in set ups and change overs There was not opportunity to obtain and place in operation new machinery, nor was there time to alter the engine design to adapt it to higher production Equipment in the plant included a limited number of production type machines such as Bullards and Warner & Swaseys The rest consisted largely of standard lathes, milling machines, grinders and drill presses Thus operations had to be based on versatility of both men and machines

Fortunately Kinner Motors, a new company, had taken over the assets of a firm which had designed an engine for relatively substantial production Thousands of Kinner engines had already been produced The company had also obtained the services of most of the men who had been with the original Kinner organiza

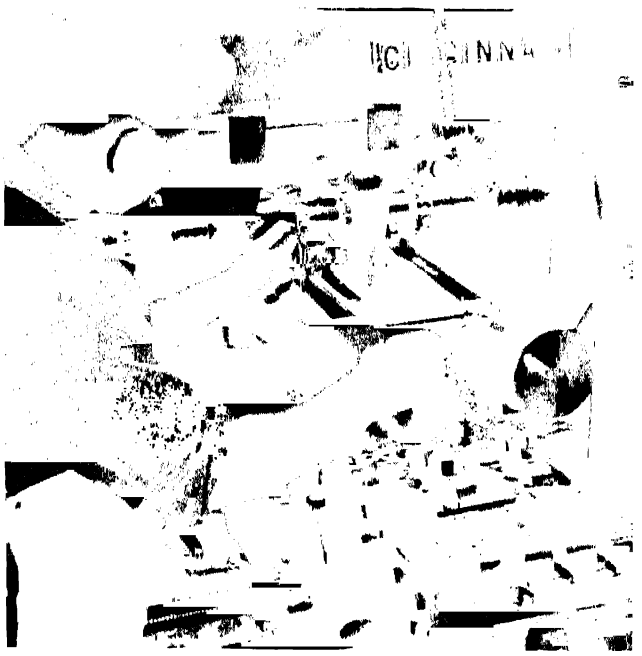


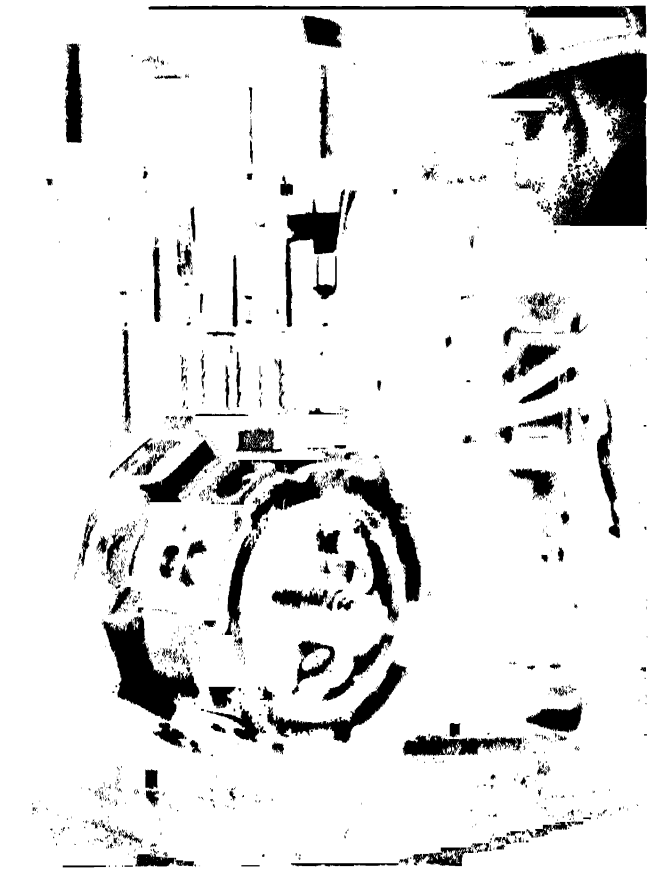
Pads for cylinder bases tappet guides and intake pipes for the five-cylinder Kinner radial engine are milled in a single operation with a special duplex milling head on a Milwaukee horizontal mill Sixth indexing point on fixture permits milling the oil sump pad, located between the two bottom cylinders Part being machined is the crankcase a one piece aluminum alloy casting

A horizontal mill equipped with a special triple head permits simultaneous boring of cylinder base hole tappet guide hole and intake port Holes are chamfered in the same operation A five point indexing fixture is used



Use of a two point fixture with this duplicate set up of master connecting rods permits milling the H section on both sides of each rod at one set up





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Fixtures as developed achieved three major objectives In a number of cases indexing jigs could be used which simplified shifting the work for a sequence of identical operations on a given piece Such a fixture is used for milling the five cylinder base pads on the main crankcase Other fixtures make it possible to perform duplicate operations in tandem as in the case of certain milling operations on connecting rods In other cases duplicate operations are performed through using indexing jigs to reverse the piece as in channel milling the H section on connecting rod shanks Various combinations of these ideas are used and full advantage is taken of many machining short cuts, such as milling two faces at once with a single set up, or doing three simultaneous boring operations with a triple head mounted on a horizontal mill

First operation on the crankcase



With this set of multiple cutting tools, seventeen fins are turned simultaneously from the solid. Rough cut is taken by the rear tools, right, chips falling directly into scrap pan. Front tools take finishing cut

is to turn a locating face at the front section where the front cover mounts. This is done in a clamp fixture. Thereafter locating fixtures are used and the case is reversed on the Bullard for boring and facing operations for mounting the rear cover, and boring the main bearing mount and oil groove. The case then moves to a Milwaukee horizontal mill where it is mounted in a six-position radial fixture and milled with a double tool head. This permits simultaneous milling of the cylinder base pads and the pads for the valve tappet guide and intake pipe fittings. The oil sump pad, located radially in the same plane as the cylinder base pads, is the sixth operation in this fixture. A Milwaukee horizontal mill equipped with a triple boring head is used to bore the cylinder base, intake pipe, and valve tappet guide holes simultaneously. The tool set-up provides for chamfering the cylinder base and intake pipe holes in the same operation by driving the tool arm in until the chamfering tools are engaged. A five-point indexing fixture is used for this operation. Another indexing fixture and drill jig is used for simultaneously drilling the eight cylinder hold-down stud holes in the cylinder base pads on the crankcase, this work being performed on a Natco Multi Drill.

Cylinder heads are held in a Warner & Swasey turret lathe by a special chuck for six successive operations, which include facing the head flange for attachment to the barrel, turning the inside diameter and machining the combustion chamber. Valve gear rocker arms are also machined on Warner & Swaseys. Master connecting rods are machined in pairs for a number of operations. They are mounted in pairs for four shank facing operations on a Cincinnati horizontal mill, an indexing fixture being used. Milling the H section channels in the master rod shanks is also done in pairs on a Cincinnati horizontal mill with indexing fixtures. For drilling, rods are paired and mounted in a Moline Hole Hog where three drills simultaneously drill the two piston pin holes and the single hole where the two big ends butt together. Bearing caps are later assembled to their rods for a finish cut.

Many operations require pot or straddle fixtures of ingenious design to circumvent the awkward shapes, from a machine standpoint, of such parts as the rear crankcase cover. This cover has two magneto pads at the rear cast integral with it and extending out for a distance approximately equal to the diameter of the cover itself.

Kinner has more than quadrupled production in six months. With the addition of newer equipment, including automatic machinery for some operations, and with the assurance of larger orders to permit still more elaborate tooling, it will be able to expand its production still more. Much credit for achieving such expansion should be given to the ingenuity and originality of the shop men, who are constantly developing new kinks for fixtures which will allow machines to reach their true capacity.

THE KINNER ENGINE

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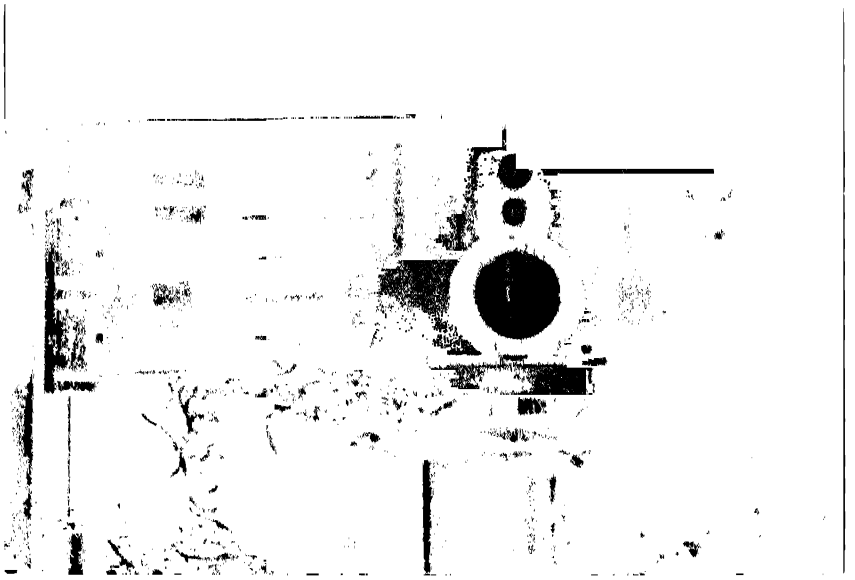
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New Fangled Furnaces

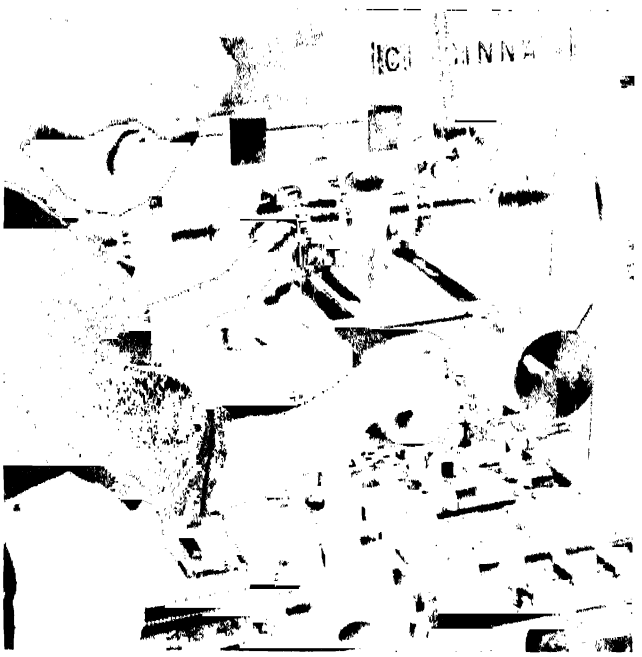
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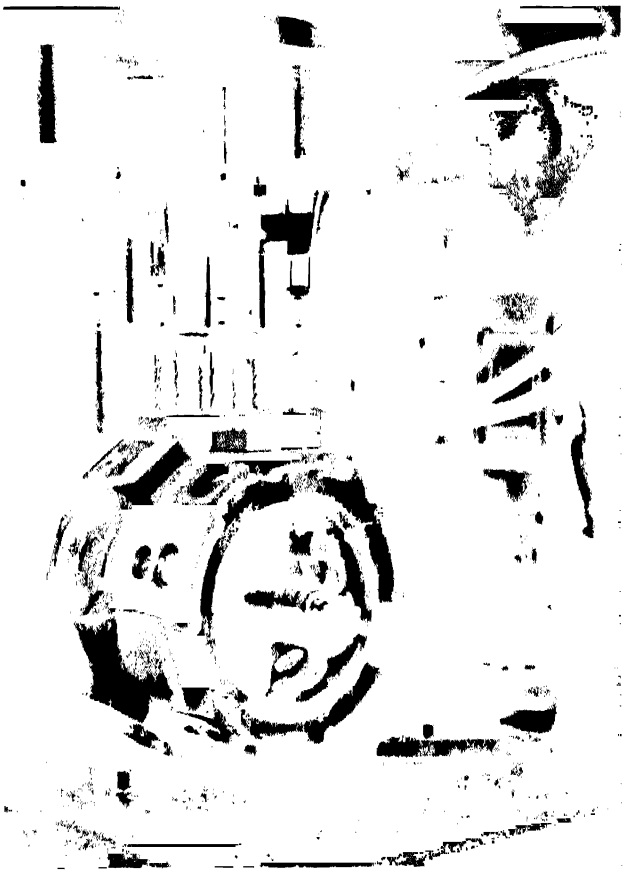
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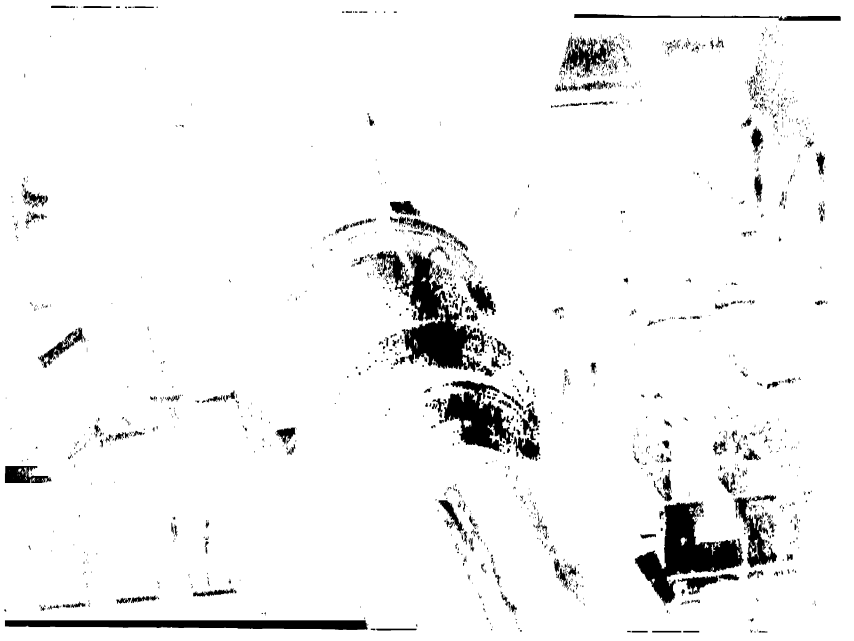


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Dial indicators for shop use

BY C C STREET CHIEF ENGINEER FEDERAL PRODUCTS CORPORATION

Dial indicators frequently are used on jigs and fixtures, as well as on inspection units. Care in mounting is essential to prevent frictional errors

THE MECHANISM of dial indicators consists of many moving parts interrelated with each other At the connection of each of these moving parts there almost invariably is a sliding surface By the time all of these frictional forces are added together they offer an appreciable amount of resistance to the motion of the instrument This means that friction tries to keep the instrument from starting and tries to prevent its return so that regardless of the action of springs in the indicator there always is a certain amount of lag in the action of the instrument The lower the spring tension with which the instrument can be made to work the less will be the friction

A little known fact concerning dial indicators is that they possess measurable amount of friction This friction is measured by mounting the instrument in a fixture and measuring the amount of force necessary to start the measuring point into motion After some assigned amount of motion has taken place usually about 0 005 in the instrument is allowed to return and the amount of force it exerts in doing so is measured At this point in the range the difference between these two values represents the amount of friction that exists in the instrument

Instruments can be made so that this frictional difference is reduced to an extremely small value but they are invariably instruments of low magnification (about 0 100 in motion of the contact point for one revolution of the hand) and of short range The term range as used here refers to the total possible travel of the contact point The best of specially constructed instruments will have a frictional difference of force of about five grams

Given the same care in workmanship as the low magnification instrument a friction of between 25 and 30 grams will be encountered at a magnification equal to 0 010 in motion of the contact point for one revolution of the hand and a total range of 0 020 in Ordinary instruments as generally used for jig and fixture work will have friction in the neighborhood of 60 to 70 grams for the higher magnification types

Without proper care in the method of mounting the instrument this friction will produce serious errors in the readings obtained Suppose an indicator is mounted at the end of a in rod some 6 in long as shown in Fig 7 and the instrument in question has a frictional rating of 60 grams If we assume that it takes 100 grams to start the instrument in motion by calculation we find that a in rod 6 in long will deflect at its end 0 0012 in for a load of 100

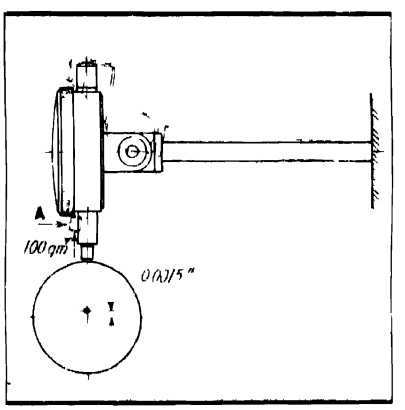


Fig 7 Unless properly supported friction in the indicator may cause it to deflect under the pressure of contact for a reading

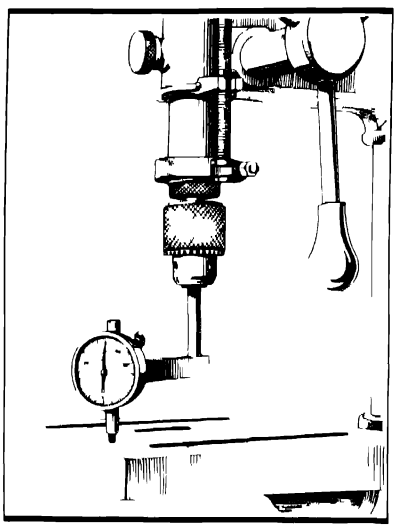


Fig 8 Simple setup with a dial indicator and V-block to determine whether the table of a drill press is square with the spindle

grams as shown by position *A* in Fig 7 In this setup the indicator itself will move upward 0 0012 in before any reading is given Now if the work is a slightly eccentric cylinder that is being slowly rotated under the contact point it will gradually move away from the instrument and the contact point will now exert only 40 grams in returning The bar will then return toward its original position until it is deflecting an amount equal to a force of 40 grams This by calculation will be 0 000496 in so that there will exist an error in the reading of eccentricity equal to the difference between these two deflection values which will be 0 000744 in If the actual eccentricity were 0 005 in the indicator would read 0 0073 in

It is obvious from this explanation that a more rigid method of mounting the instrument would reduce the error appreciably and by the use of a proper fixture it could be made unimportant One very simple way

of determining the reliability of any indicating set-up is to place the part to be measured under the contact point and then with the finger pressed against the case of the instrument slightly depress it downward The pressure of the finger is now gradually released so that the instrument returns to its original setting This return must be allowed to take place very slowly, so that inertia of the moving parts will not carry it beyond the point at which it otherwise would stop The value of this reading is noted, and the instrument is then pressed upwards in the same manner and slowly released It will be found in most instances that the two final readings are not alike, and may differ by as much as 0.003 or 0.004 in This difference represents the error that can be caused by friction in the instrument when the readings are taken



Fig 9 By clamping an indicator on a lathe it is a simple matter to reposition the carriage accurately

Errors From Pressure Variations

When indicators are used on light and delicate parts the actual force exerted by the contact point is of importance since this force can produce a change in the part being measured just as the friction in the instrument can produce a change in the mounting fixture In nearly all instances contact pressure can be kept at its lowest value when the range is short This is due to the fact that there is only a limited amount of space in the case of the instrument and if for example $\frac{1}{2}$ in is needed for travel and the instrument has a diameter of $1\frac{1}{2}$ or 2 in there will only be left approximately $\frac{1}{2}$ to $\frac{3}{4}$ in space for the spring This means that a spring must be designed capable of extending $\frac{1}{2}$ in yet being only slightly more than $\frac{1}{2}$ in in free length since it must exert a certain amount of pressure when the instrument is in its fullest extended position An examination of spring tables will show that such a spring will invariably have a high spring rate (increase in force for a given amount of extension) and this means that the force exerted by the contact point will increase rapidly under such an arrangement When a short range instrument is used it is possible to actuate the mechanism with a long soft return spring, and in this manner there is of course, less change in contact pressure over the working range Instruments having a working range of $\frac{1}{2}$ in will often have a starting force of around 100 grams which will increase at the end of their travel to some 200 or 300 grams which represents almost $\frac{3}{4}$ lb

It is well to note that this change in contact force can also produce an error in reading just as that produced by friction since the instrument will start at 100 grams of force which will produce a deflection in a $\frac{1}{16}$ in rod 6 in long of 0.00124 in but by the time the entire range has been used the pressure exerted by the contact point will be 500 grams and the deflection of our $\frac{1}{16}$ in rod will be 0.00577 in We, therefore have an error in readings equal to the difference between these two values which will be 0.00453 in

Squaring a Drill Press Table

By applying simple principles of geometry many measurements can be made with dial indicators that are independent of any outside standard An example of this might be where one desired to ascertain if the table of a drill press is square with the spindle One method used by many mechanics is to place in the chuck a piece of drill rod and then place a toolmaker's square on the table and see if the blade is parallel with the drill rod The accuracy of this test depends in the first place on whether or not the jaws of the chuck are in true alignment with the axis of rotation of the drill spindle and secondly if the piece of drill rod is truly straight A third item that must be watched for this test is the square itself

It can be seen easily that with so many factors controlling the reliability of the results there is apt to be some doubt as to the value of the readings obtained This problem can be simply solved by using a dial indicator set up as shown in Fig 8 The bar may be made of any piece of cold rolled steel by simply drilling two holes at right angles in the opposite ends of the piece, one to receive the indicator and the second tapped to receive a rod held in the drill chuck The spindle is lowered until the indicator touches the table, then it is locked in place and slowly revolved The squareness of the table is determined by observing the amount of movement of the indicator hand and can be read easily to 0.001 in at a radius of 6 or 7 in from the drill spindle This represents a check so accurate that if the table were out of square by an angle of 30 sec it could be determined by this method Checking with this method gives the true out of squareness between the table and the axis of rotation of the spindle and will not include any chance misalignment of the chuck jaws

A convenient application of indicators consists of measuring the longitudinal travel of a lathe carriage as in Fig 9 A simple clamp can be designed so that it will hold an instrument on one of the outer dovetails of the lathe bed, so that the contact point can touch a smooth surface on the carriage Very accurate parts have been made by this method Some parts recently made were stuffs similar to those used in watches where the diameters were in the neighborhood of 0.030 or 0.040 in and the shoulders in the steps of some 0.025 to 0.030 in These experimental parts later were checked with a microscope and found to be accurate within plus or minus 0.0005 in

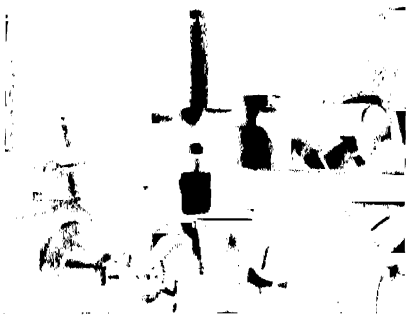
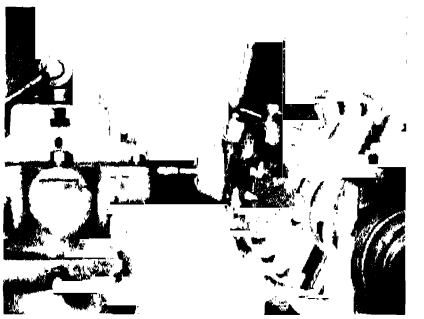


Fig 5—The first operation is the cylindrical grinding of the periphery of the cutter



Fig 6—The second operation consists of grinding face of cutter with a silicon-carbide wheel



Photos Courtesy Ex-Cell-O Corporation

Fig 7—The third operation consists of cylindrical grinding chamfer on the cutter blades

Grinding carbide cutters

BY FRED W LUCHT ENGINEER CARBOLOY COMPANY

II—Accurately ground milling cutters are produced easily by following this suggested series of operations. Cut-and-try is eliminated and costs are cut

WHEN A MILLING CUTTER is returned to the toolroom for sharpening, the cutting edges should be examined carefully for signs of abuse, and to determine the type of dullness. As a result of this inspection an experienced supervisor can determine whether better performance might be obtained by increasing or decreasing the rake and clearance angles.

Before resharpening, the chip clearance between the cutting edges and the cutter body should be checked. If insufficient, this space may sometimes be increased by grinding, in the case of a solid cutter, or by resetting the blades of an inserted tooth cutter. The cutter should be inspected for distortion and hole wear, and corrected as necessary. Burrs on the edges of holes, counterbores or drive keyways are removed with a hand stone before resharpening the cutter.

Cutter Grinding Routine

When grinding carbide-tipped cutters with either straight or cup wheels, the wheel always should rotate onto the cutting edge, that is, from tip toward shank as indicated in Fig 3.

The following general instructions, discussed in the first part of this article (*AM*—Vol 84 page 603), apply to all of the grinding operations described below for carbide tipped milling cutters. (1) Wheel speed will range from 2 700 to 5 500 ft per min. (2) When using a cup wheel swing the wheel spindle slightly so heel of wheel will clear work. (3) Wheel in feed per pass should be 0.002 in. when cylindrical grinding and when grinding rough back off with silicon carbide wheels, and 0.0003 to 0.0005 in. when sharpening (applying final finish) with silicon carbide or diamond wheels. (4) Use steady hand feed of about ¼ in. per second. (5) Keep grinding wheels open and free cutting. When necessary, use a wheel dresser on silicon carbide wheels. If a diamond wheel loads, use a cake of pumice stone to clear the wheel face.

The routine for successfully sharpening multi blade milling cutters divides itself into four general classifications, based upon the condition of the cutting edges before they are sharpened.

1. All tips of an inserted blade cutter worn down to where they will not cover depth of cut. Cutter needs new set of blades. Use all grinding operations Nos. 1 through 10 as outlined below. This involves complete resharpening of the cutter.

2. If all cutting edges of an inserted blade cutter are sharp, with the exception that one or more blades are

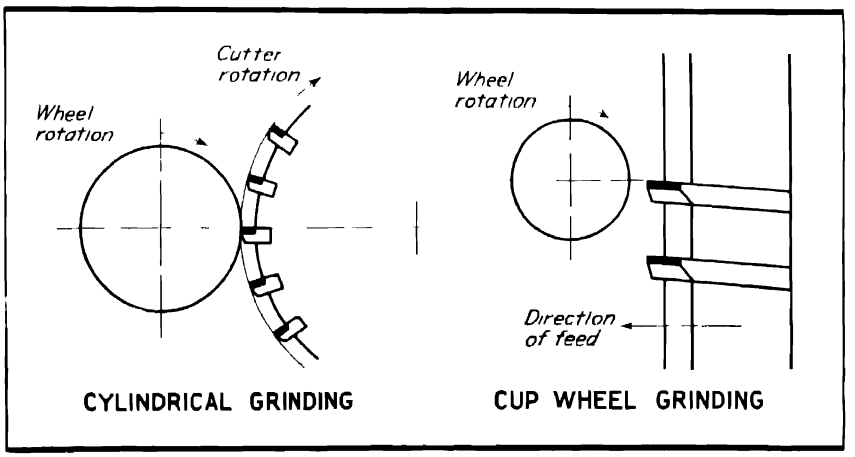


Fig 3—Best results are obtained by driving the grinding wheel so that it will rotate from the tip toward the shank of the blade

Fig. 8—In grinding tooth back-off on the periphery, tooth rest is lined up with wheel and cutter centers

Fig. 9—The tooth rest is set off center an amount shown in Tables I and II to give desired clearance

Photos Courtesy Ex-Cell-O Corporation

Fig. 10—The fourth operation is the grinding of rough back-off on each tooth of the cutter

damaged and must be replaced, use operations 4 through 10.

3 If none of the teeth are damaged and all cutting edges are dull, and the diamond wheel would come in contact with the steel shanks, use operations 4 through 10.

4 If all cutting edges are dull, none of the teeth are damaged in any way, and it is possible to sharpen the cutter without contacting the steel shanks with the diamond wheel, use operations 5, 7, 9 and 10 for reconditioning the cutter.

In all cases where blades must be removed from the cutter body, the damaged blades should be ground separately to a templet before replacement in the body. The templet should be taken from a new, finished blade. If new blades do not conform closely to those in the cutter they should be hand ground to the templet on a pedestal-type grinder, using a silicon-carbide straight wheel. A dial indicator should be used when reassembling blades in a cutter body, so that all blades will be set to a uniform height and grinding time can be held to a minimum.

A modification of the following general procedure for sharpening inserted-blade face mills also is applicable to the grinding of other milling cutters, core drills, finish boring tools, counterbores, spotfacers and hollow mills. Blade shapes generally recommended for face mills are shown in Fig. 1. In sharpening carbide tipped face mills and other milling cutters the following sequence of operations has been found to give best results:

1 *Circle grind periphery.* Set up cutter on adapter and cylindrical grind both carbide and steel on outside diameter of the cutter with a silicon carbide straight wheel, as in Fig. 5. When work specifications demand a better-than-average finish, Operation 1 should be followed by Operation 1-A, which is a repetition of Operation 1 using a diamond wheel.

2 *Surface grind side of teeth.* Swing wheel head and surface grind both carbide and steel on face (side teeth) of cutter, as in Fig. 6, with silicon-carbide straight wheel. As in Operation 1, Operation 2 may be followed by Operation 2-A using a diamond wheel when work specifications require a better finish than average.

3 *Circle grind chamfer.* Swing compound table to chamfer angle and cylindrical grind carbide and steel on chamfer of cutter with silicon-carbide straight wheel. See Fig. 7. Operation 3-A is the same as Operation 3, except that a diamond wheel is used, it is employed when a better-than-average finish is required on the work.

4 *Rough back off periphery.* Remove cutter from the adapter used for Operations 1, 2 and 3, and mount on grinding attachment. Set grinding attachment to grind rough back-off and sharpen periphery. Replace straight grinding wheel with silicon-carbide cup wheel.

Next, line up wheel center and cutter center in either the same horizontal or vertical plane, depending on the machine used. Set up tooth rest and adjust its end in line with wheel and cutter centers, as in Fig. 8. A surface gage with a scriber point will be found helpful. Then adjust tooth rest off center amount determined from Tables I and II sufficient to give desired clearance, as in Fig. 9.

Grind rough back off on each tooth of cutter up to land width of 0.010 to 0.030 in. as shown in Fig. 2 (*AM* Vol. 84, page 603). It may be necessary to swing the compound

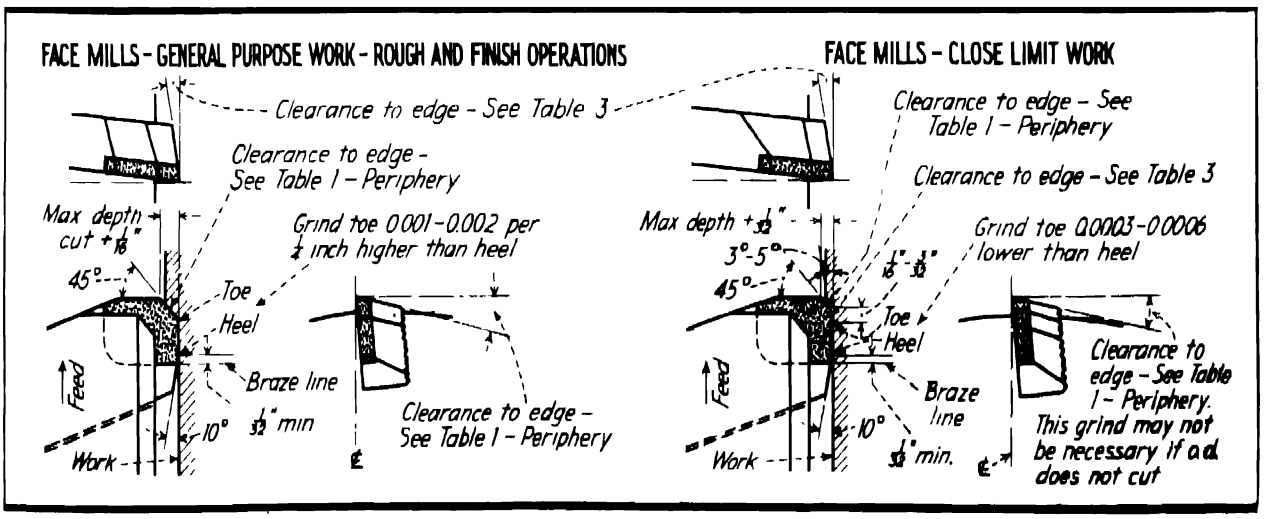


Fig. 4—Carbide-tipped face mills are ground to suit the requirements of the job at hand. Diamond wheels are recommended for final grinding operations where work specifications demand a better-than-average finish



Fig 11—The sixth operation consists of grinding rough back-off of the side teeth on the face of the milling cutter



Fig 12—This set-up is used for grinding rough back-off on the chamfer in Operation 8. Use a silicon-carbide wheel



Photos Courtesy Ex-Cell-O Corporation

Fig 13—The heel of the blade on face of the cutter is ground in this set-up during Operation 9, using a silicon-carbide wheel

table of the grinder in order to obtain a uniform land width. Set up for Operation 4 is shown in Fig 10

5 *Sharpen periphery* — Adjust tooth rest for cutting clearance on carbide (See Fig 2 and Tables I and II). Grind clearance to edge of each tooth on outside diameter of cutter It may be necessary to swing compound table in order to obtain a uniform cutter diameter Set up is the same as that shown in Fig 10, except that a diamond flaring cup wheel is used

6 *Rough back off side teeth*— Swing grinding attachment to position for grinding face (side teeth) of the cutter, as in Fig 11 Tilt cutter vertically an amount sufficient to give the desired rough back off angle This angle is shown directly on the vertical graduated scale of the grinding attachment Recommended clearance angles for side teeth are given in Table III

Rotate cutter until the cutting edge of one side tooth is approximately horizontal Adjust tooth rest to the face of this tooth Grind each tooth up to a land width of 0 010 to 0 030 in as shown in Fig 2 Use a silicon-carbide cup wheel It may be necessary to swing the compound table to obtain a uniform width of land

7 *Sharpen side teeth* — Loosen tooth rest and reset grinding attachment for cutting clearance on side teeth by reducing vertical tilt angle See Fig 2 and Table III Rotate cutter until cutting edge of one side tooth is in an approximately horizontal position, then adjust tooth rest to the face of this tooth Set up is same as that shown in Fig 11, except that a diamond flaring cup wheel is used Grind clearance to edge on each tooth It may be necessary to swing compound table to obtain needed high or low heel

8 *Rough back off chamfer* — Reset grinding attachment to horizontal position Swing attachment to position for grinding chamfer. Adjust tooth rest for rough back-off on chamfer (See Fig 2 and Tables I and II) Use a silicon-carbide cup wheel and grind each tooth up to a land width of 0 010 to 0 030 in It may be necessary to swing compound table Set up is shown in Fig 12

9 *Sharpen chamfer*— Adjust tooth rest for cutting clearance on carbide (See Fig 2 and Tables I and II) Grind clearance to edge on each tooth on chamfer of cutter It may be necessary to swing compound table Set up is the same as shown in Fig 13 for Operation 8, except that a diamond flaring cup wheel is used

Table II—TOOTH REST SETTINGS FOR CLEARANCE ON PERIPHERY OF MILLING CUTTER

Cutter Diameter in inches	Peripheral Clearances (Expressed in inches indicator drop $\frac{1}{16}$ in. behind cutting edge)												
	0.005	0.006	0.007	0.008	0.009	0.010	0 011	0 012	0 013	0 014	0 015	0 016	0.017
	Set tooth rest off center in thousandths of an inch as follows												
½	0.051	0.055	0 059	0 063	0 067	0.070	0.074	0.078	0 082	0 086	0.089	0.093	0 097
¾	0 061	0 067	0.073	0.079	0.085	0.090	0.096	0.102	0 108	0.114	0.119	0.125	0.131
1	0.071	0.079	0 087	0.095	0.103	0 110	0 118	0 126	0.134	0 142	0.149	0.157	0.165
1¼	0 081	0 091	0.101	0 111	0.121	0 130	0.140	0.150	0.160	0 170	0.179	0.189	0.199
1½	0.091	0.103	0.115	0.127	0.139	0.150	0 162	0.174	0.186	0.198	0.209	0.221	0.233
2	0.111	0.127	0.143	0.159	0.175	0.190	0.206	0.222	0.238	0.254	0.269	0.285	0.301
3	0.151	0 175	0.199	0.223	0 247	0 270	0 294	0 318	0.342	0.366	0.389	0 413	0 437
4	0.191	0.223	0 255	0 287	0 319	0.350	0.382	0 414	0.446	0.478	0.509	0.541	0.573
5	0.231	0 271	0 311	0 351	0 391	0 430	0.470	0.510	0.550	0.590	0.629	0.669	0.709
6	0.271	0.319	0.367	0 415	0 463	0.510	0.558	0.606	0.654	0.702	0 749	0.797	0.845
7	0.311	0.367	0.423	0 479	0 535	0.590	0.646	0.702	0.758	0 814	0.869	0 925	0.981
8	0.351	0 415	0.479	0.543	0.607	0 670	0 734	0.798	0.862	0 926	0 989	1.052	1.117
9	0.391	0.463	0.535	0.607	0.679	0.750	0.822	0.894	0.966	1.038	1.109	1.181	1.253
10	0.431	0.511	0.591	0.671	0 751	0.830	0.910	0.990	1.070	1.150	1.229	1.309	1.389
11	0.471	0.559	0.647	0 735	0.823	0.910	0.998	1.086	1.174	1.262	1.349	1.437	1.525
12	0.511	0.607	0.703	0.799	0 895	0.990	1.086	1.182	1.278	1.374	1.469	1.565	1 661
14	0.591	0.703	0.815	0.927	1.039	1.150	1.262	1.374	1.486	1.598	1 709	1.821	1.933
16	0 671	0 799	0.927	1.055	1 183	1.310	1.438	1.566	1.694	1.822	1.949	2.077	2.205
18	0.751	0.895	1.039	1.183	1.327	1.470	1.614	1.758	1 902	2.046	2.189	2.333	2.477
20	0.831	0.991	1.151	1.311	1.471	1.630	1.790	1.950	2.110	2.270	2.429	2.589	2.749
22	0.911	1.087	1.263	1 439	1.615	1.790	1.966	2.142	2.318	2.494	2.669	2.845	3.021
24	0.991	1.183	1.375	1.567	1.759	1.950	2.142	2.334	2.526	2.718	2.909	3.101	3.293
26	1.071	1 279	1.487	1.695	1.903	2 110	2 318	2 526	2.734	2.942	3.149	3.357	3.565
28	1.151	1.375	1.599	1.823	2.047	2 270	2.494	2.718	2.942	3.166	3.389	3.613	3.837
30	1.231	1.471	1.711	1 951	2.191	2.430	2.670	2.910	3.150	3.390	3.629	3.869	4.109

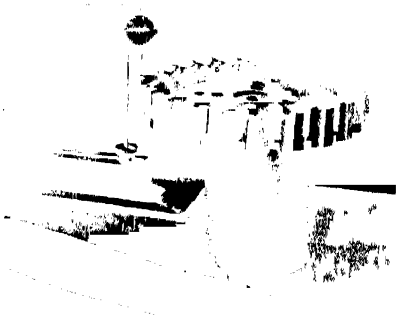


Fig 14—The run-out on the face of the cutter should be checked carefully on each tooth keeping readings within values shown in Table II

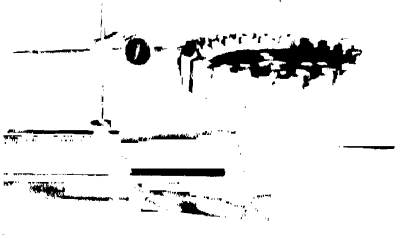


Fig 15—Check run out on the outside diameter No consecutive teeth should have a variation greater than half of the total permissible run out



Fig 16 The run out of the chamfer should be checked at the corner of each tooth

Photos Courtesy Kelly Mill Machine Co

10 *Grind heel* Swing grinding attachment to desired angle for removing steel at heel of blade on face of cutter See Fig 13 Set tooth rest to eliminate interference of wheel with adjacent teeth Grind teeth so that cut runs out on each tooth $\frac{1}{2}$ in above braze line as shown in Fig 1 Use a silicon carbide cup wheel

Inspection After Sharpening

The following procedure should be followed in general during the inspection of sharpened carbide tipped milling cutters (1) Inspect all carbide tips for grinding checks and chipped faces (2) Inspect all blade locking devices (3) Inspect hole in cutter (4) Inspect counter bore (5) Inspect back face and drive slots (6) Inspect cutting clearance on outside diameter, chamfer and side teeth (7) Inspect side teeth for relation of heel and toe (8) Inspect cutter for run out

Cutting clearance should never be considered as satisfactory because it looks right but should be checked with a dial indicator, as in Figs 14 15 and 16 If no inspection fixture is available, a dial indicator mounted on a base can be used on the table of a grinder or milling machine The indicator point should have a $\frac{1}{64}$ in radius spherical point to aid in finding the contact point

To use the indicator in determining cutting clearance

1 Scribe a line $\frac{1}{16}$ in behind the cutting edge, and parallel to it

2 Place dial indicator so point is on cutting edge and set dial to zero reading

3 Rotate cutter forward until scribed line is directly below indicator point The drop in indicator reading is a measure of cutting clearance See Figs 1 and 2 and Table I

Cutter run out should be checked with the cutter mounted in exactly the same manner as it was mounted for sharpening and will be mounted when in use Good practice indicates that the total run out should be kept within the dial indicator readings shown in Table IV When inspecting run out on outside diameter no consecutive teeth should have a variation greater than one half of total allowed run out

Table III—VERTICAL TILT FOR GRINDING ATTACHMENT

(When Grinding Side Teeth of Milling Cutters with a Cup Wheel)

Material	Angle in Degrees Clearance at Cutting Edge	For Rough Back Off
Aluminum	5	8
Brass	4	7
Bronze	4	7
Cast Iron	4	7
Copper	6	9
Fibre	6	9
Malleable Iron	4	7
Plastics	6	9
Rubber Hard & Medium	6	9
Steel	4	7
Zinc Die Castings	6	9

Table IV—FACE MILL RUN-OUTS FOR ROUGH AND FINISH CUTS

Cutter Diameter	Roughing Cuts Face	Roughing Cuts O D & Chamfer	Finishing Cuts Face	Finishing Cuts O.D & Chamfer
Up to 12"	0 001	0.002	0.0005	0 0015
12" to 16"	0 0015	0 003	0.00075	0 002
Over 16"	0 002	0.004	0 001	0.0025

Fighting Aircraft Corrosion

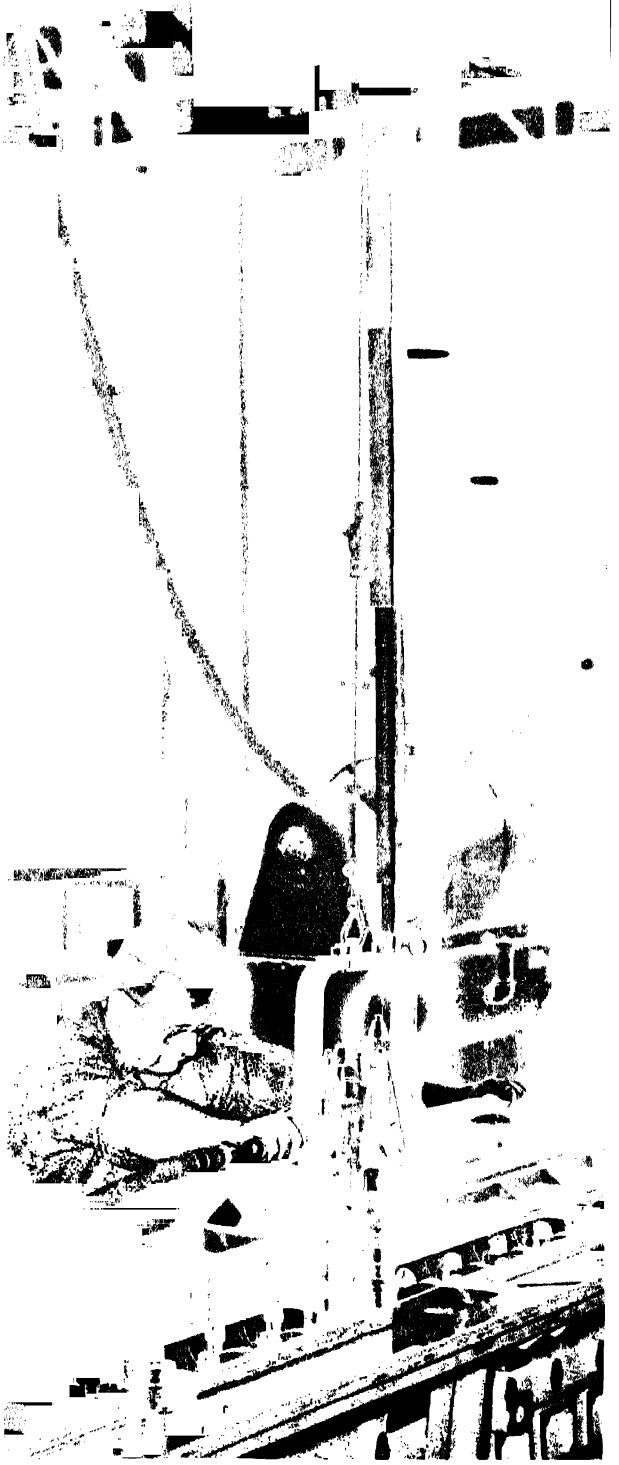
Methods for reducing corrosion of alloys used in aircraft construction have been developed by the National Bureau of Standards in cooperation with federal aeronautical agencies and manufacturers Methods of heat treatment have been developed that eliminate intercrystalline attack in aluminum alloys Also it has been found that pitting in these alloys can be minimized by making the alloys from high purity components, and by keeping the copper and iron contents low

Binary magnesium aluminum alloys were found to become more susceptible to corrosion as the aluminum content was increased, but small additions of zinc or tin rendered these alloys more resistent to attack Stainless steel of the 18 8 type containing small additions of molybdenum were more corrosion resistant than similar alloys without addition elements or those with small additions of titanium

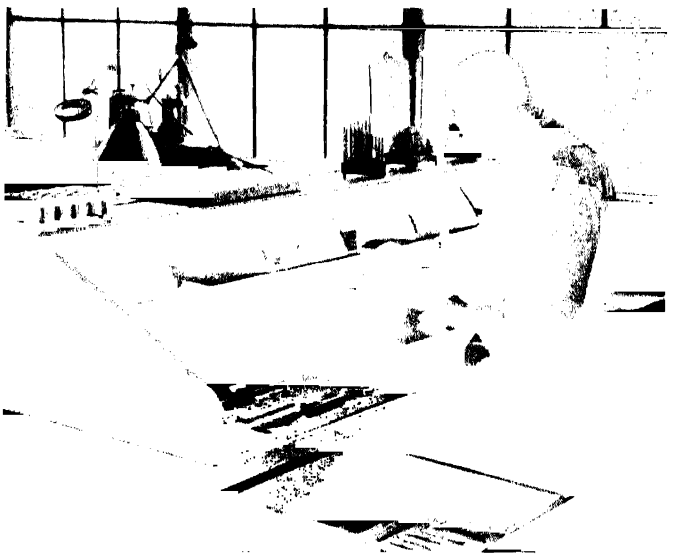
These conclusions are based on tests of some 25 000 specimens representing 60 different alloys which were corroded by accelerated methods in the laboratory or by exposure to the weather or to sea water Loss in tensile properties was used as an index of the amount of corrosion or it was measured directly on cross sections examined with the microscope at high magnification

The Bureau of Standards has succeeded in developing surface coatings for both aluminum and magnesium alloys which markedly improve their resistance to corrosion under severe exposures to salt air Corrosion is affected by riveted joints gas welds seam welds and spot welds Important data also were obtained on the potential effects involved when alloys of different chemical compositions were exposed to corrosion in contact with each other

Shop shots



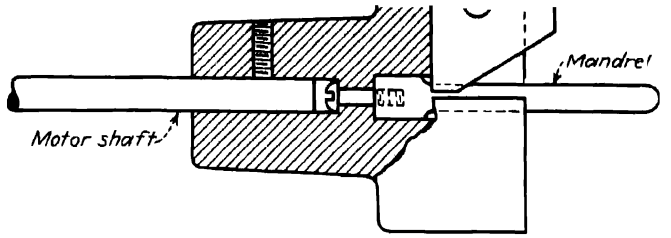
To prevent injury to the operator in case a close-fit main bearing stud series, this air motor is held in a steel yoke which is kept from turning by the telescoping square tubes, while its weight is supported by a spring balance. Bearing welded to end of largest tube pivots on a bar, the ends of which are supported on rollers from an overhead I-beam. Caterpillar Tractor Company



Precision parts are inspected at this bench which is equipped completely enough for the majority of inspection jobs encountered. Gages and inspection tools are kept in orderly arrangement on recessed boards in drawers. Pigeon-holes for papers and records leave the top of the bench free for inspection work. Expensive or infrequently used inspection devices are kept in the toolroom. Wright Field; Official U. S. Army Air Corps photo

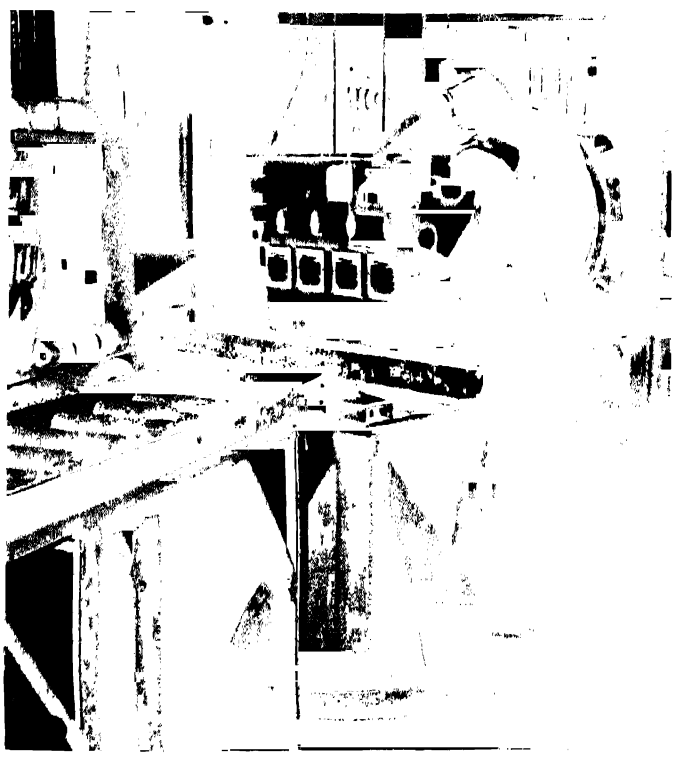


In drilling and tapping holes in large castings, it has been found that production can be economically improved with radial drills by using supplementary bed plates. In this illustration two bed plates are placed alongside the standard plate furnished with the drill. This permits a first-class machinist to perform all necessary operations on one part, while a helper sets up another casting on the other bed plate and puts the jigs in place. With this arrangement it is simple for the operator to move the drill arm from one casting to the next while the helper precedes him in placing the proper jig. A wooden platform built around the bed plate makes it convenient for the operators to move around and enables them to see better. Kearney & Trecker Corporation





This device puts a 15 deg cutting edge on steel and brass cork cutters in production quantities The hollow cork cutter is supported on a mandrel of the proper diameter, which is held in the collar along with the high speed cutting tool, shown in the sketch The mandrel is grooved at one end to hold the edge of the cutting blade so that it will not ride up on the cork cutter tube without putting the proper edge on it Cork cutters are supported in the V block which can be elevated by the two screws to suit the diameter of the cutter A sheet metal guard, not shown, is placed over the revolving collar to keep chips from flying Precision Scientific Company



Revolving conveyor section eases the job of changing direction of cylinder block motion along the machining line Stand pipe and steel plate are welded together to form the base which supports the conveyor section Conveyor rails are mounted on a welded channel, plate and tube structure Caterpillar Tractor Company



Time is saved by wrapping electric oven heating elements with resistance wire right at the spot welding machine Wire and its spool are held by a yoke fastened to the welder base After the free end is spot welded to the metal conductor at one end of the porcelain insulator the assembly is dropped into slots in a rotating fixture fastened to the welder columns The slots fit the flat end of the metal conductors Resistance wire is then wrapped around the insulator by turning the hand crank After cutting with scissors, the wire end is spot welded to the element connection Precision Scientific Company



When threaded parts have been carburized, this arrangement is applicable to a wide variety of parts where it is desired to draw the threads back from the brittle stage City gas mixed with oxygen is fed to the torch held over the work table as shown The operator holds the piece with tongs while turning the threaded portion under the flame By watching the color of the piece, he can regulate the speed with which the thread must be moved under the flame to get the proper draw Parts are supported by a bent frame made of steel bar welded to a steel base plate After this operation, they are air-cooled Independent Pneumatic Tool Company

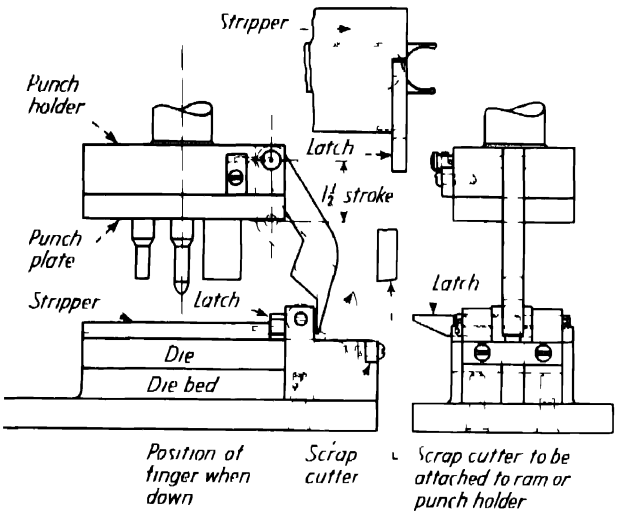
IDEAS FROM PRACTICAL MEN

Finger Feed for Blanking Dies

By HENRY W FALSTROM
Tool Engineer Eastern Tool & Mfg Company

The type of finger feed for blanking dies illustrated has proved itself very practical and dependable Once fitted it requires no adjustments It remains with the die and is not transferable from one die to another

Shaping and fitting the finger should be done in the press where the die is to be used A finger fitted to a press with a $1\frac{1}{2}$ in stroke cannot be used in a press with a 2 in stroke The feed consists of a bracket set in front of the die This bracket contains a roller for the finger to ride on and also supports the scrap when the finger is feeding A scrap cutter can also be attached to this bracket as shown A latch is fitted to the stripper that allows the scrap to go under but forbids it to be pulled back This latch should drop from its own weight when the heel of the finger is on the center of the roller



This figure feed for blanking dies hinges in the punch holder or punch plate and drops back from its own weight during the upstroke of the punch

The finger hinges in the punch holder or the punch plate It is removable by hand and should have a locking device as shown to prevent it from sliding out The finger is so hung that it will drop back from its own weight after the up stroke When stroke is up the tip of the finger should clear the scrap by at least $\frac{1}{16}$ in On the down stroke the finger should enter into the scrap at least $\frac{1}{4}$ in before starting to feed When the heel of the finger is on the center of the roller, it is through feeding The latch drops and the pilot enters It is well to relieve the finger a trifle as shown in the down position of finger to allow the pilot to index properly

In starting a new coil of material take the finger out Feed enough blanks by hand until the scrap protrudes under the roller Put the finger back in and start the press

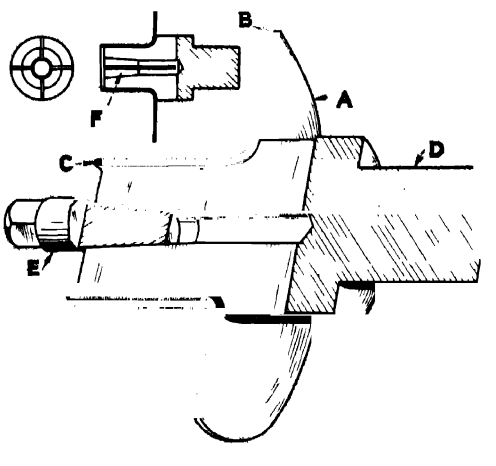
We are using this type of feed on many of our dies and find it very dependable especially on dies where production requirements are large

Split Arbor for Trimming Flanges

By E O SCHRAY

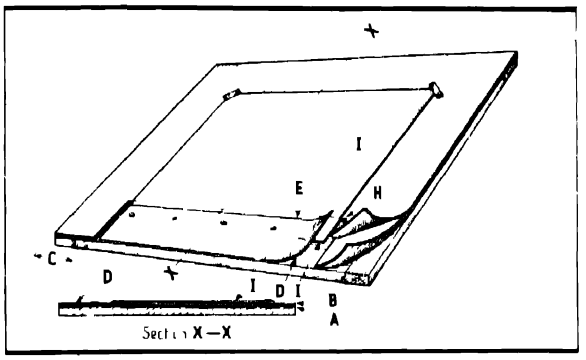
Recently we were confronted with the problem of trimming flange *A* shown in the drawing it ends *B* and *C* at the same time It could not be mounted on the chucks we had available because of the large radius So we made the illustrated split arbor *D* which worked very satisfactorily The split arbor has two slots at right angles to each other going about $\frac{3}{4}$ in further back than flange *A* when it is slipped on This allows easier expansion

After flange *A* is in place the tapered pin *F* is driven into the tapered hole *E* with a light blow of the hammer A 6 deg included angle on both pin and hole give the desired performance After the trimming operation we take a suitable wrench (about 6 in long) to fit the square at end of pin *F* and give it a



A split arbor expanded by a tapered pin was used to trim both ends of this large diameter flange simultaneously The arbor can be tapered to fit the headstock rather than chucked in the lathe if precise concentricity of the flanges is desired

quarter turn, which is enough to loosen and remove the flange without dropping the pin Arbor *D* was held in a chuck, but could be made with a taper to fit the headstock of the lathe to insure greater concentricity on repeat orders Arbor *D* was made of cold rolled steel and pin *E* of drill rod hardened and tempered to stand a blow on the square end



If a manila paper mortised as shown can be used to prevent the bottom edge of the vellum from curling or tearing by the movement of tools and straight edges

Prevents Edges of Vellum From Tearing

By DONALD A BAKER

Vellum drawing paper is brittle and easily torn especially along the bottom edge where tools and straight edges are constantly being moved over it To eliminate this trouble I cover the top of my drawing board with two sheets of heavy manila paper *A* and *B* Rectangular sections are cut from sheets *A* and *B* near the bottom of the drawing board The height of the rectangular section depends on the location of the lower edge of the vellum when placed on the drawing board while the width of the section is made a little larger than the maximum width of the largest piece of vellum to be used This leaves margins *C* on both sheets *A* and *B* which extends from the bottom of the board to 3 in above the bottom edge of the vellum One of the rectangular pieces cut from sheets *A* and *B* is discarded, while the other is located at *D* in the drawing however the piece is trimmed to form margins *I* and *H*

In use, a sheet of drawing paper *J* with border lines previously drawn, is placed on top of sheet *B* and the lower edge is slid under strip *L* The border lines are adjusted by straight edge and it is then tacked or held in place with gummed tape With this arrangement the straight edge slides smoothly over the piece since there are no raw edges to curl up and catch

Use an Air Motor to Raise a Shaper Table

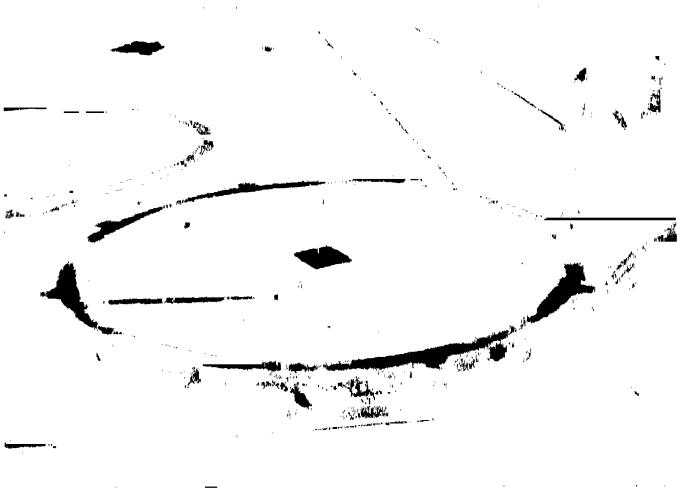
By EDWARD N OLSON

There are shapers today which still lack an automatic mechanism for elevating the table A No 3 air motor will do the job quickly when fastened to the shaper table screw shaft Of course, this will not lower the table but the weight of the latter will assist greatly in this operation I recently operated a 26 in shaper and had to move the table its maximum distance The air motor simplified the job

Ball Bearing Spider Improves Layout Table

A simply constructed work support recently developed by Victor Sherwin at the East Pittsburgh Works of Westinghouse Electric & Mfg Company permits the workman to stay at one convenient location and rotate the piece being marked at will This fixture is suitable for laying out circles on large pieces

Three steel bars of sufficient strength to support the work are welded in spoke like fashion to a steel block This block is then set on a ball thrust bearing which is placed on the layout table Steel pipes may be slid on the bars to increase the working diameter of the assembly The bearing assembly shown in the accompanying illustration has supported pieces weighing four tons



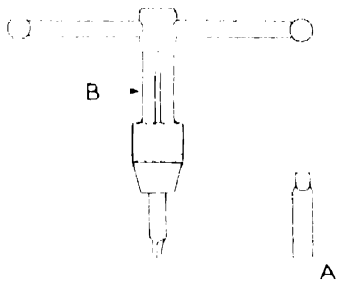
Three steel bars welded to a steel block and a ball thrust bearing make up a convenient fixture for holding circular parts to be laid out for machining It will hold work weighing four tons

To find a center a flat steel block with a center punched in it is laid on the bearing assembly as shown The block then is moved about on the bearing until the correct center is found Not only does this fixture save the workman's time but it reduces effort in laying out large pieces brought to the table

Screwdrivers for Close Quarters

By C F FITZ

In our assembly and maintenance work there are many screws to be inserted or removed from very odd difficult and inside places To overcome this difficulty we made sets of screwdriver bits, as shown at *A* in the accompanying illustration They were made from worn or broken taps and had the squares left on the shanks and were held in an ordinary T handled tap wrench



Screwdriver bits held in a key-type wrench having a sliding T-handle can be used in close quarters. The bits are made from worn or broken taps

having a sliding handle, as shown at *B*. The use of these screwdrivers not only increased the efficiency of the workmen, but prevented the slots in the screws from being chewed up, as they would be by an ordinary screwdriver held at an angle.

Ingenuity Plus Welding Saves Money

By ARTHUR HAVENS

I am at loss to explain the surprising number of ingenious devices made by welders. It may be that the extreme flexibility of the welding trade has something to do with it, or the welders have some special inventive ability—probably a combination of both. At any rate, every shop I visit the same conditions exist most of the shop oddities are welded. Here are some examples of how welding saved a railroad shop money.

It had always been the custom in the shop where I was recently employed to roll the superheater flues on the firebox end by hand. This was necessary because of the cramped quarters in the firebox. One day while watching a boilermaker and his helper sweat and strain on a big roll, a welder suggested that they weld two air-motor collets to a length of $1\frac{1}{2}$ in. pipe, making the pipe long enough to reach to the deck outside the firebox door. Willing to try anything to help make this job easier, the suggestion was followed. Two helpers were stationed on the deck to operate the motor and the boilermaker stayed inside to guide the roll; needless to say this idea proved a boon to the boilermakers, and resulted in reducing the time necessary to roll the complete set of superheater flues.

Removing loose driving wheel keys in the enginehouse often presents a difficult problem to the unlucky mechanic who gets the job. However, this can be simplified by following the advice of a welder. A bolt with a body size slightly smaller than the key is scarfed welded to the end of the key with the threads protruding. Over the bolt is placed a piece of tubing or washers, just leaving enough of the bolt for a full nut. By taking a strain on the nut, the key will come out easily. It is a simple matter to add more washers or change the length of the tubing until the key is removed.

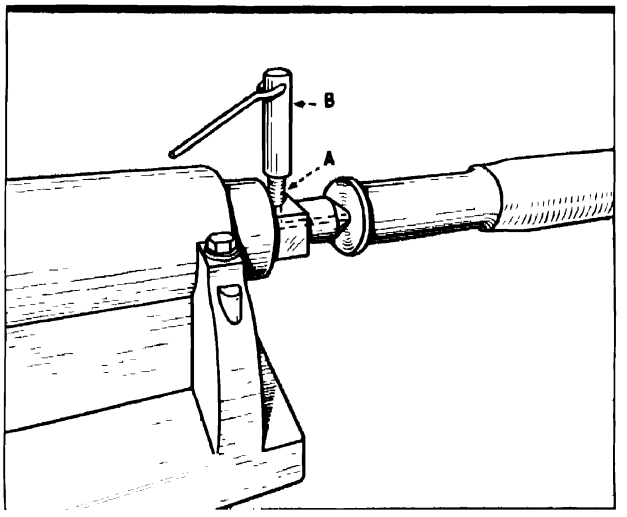
When a railroad is in receivership, the stores department may accept devices made from scrap material. Take an oil cup for instance. The welder rolled a piece of iron into a cone and welded thereto a $1\frac{1}{2}$x$2\frac{1}{2}$ in. nipple for screwing the cup into crosshead guides. Since curled hair is used in such oil cups, two pieces of $\frac{1}{8}$-in. rod were welded across the top of the oil cup to keep the hair from falling out. Just another idea that saved money for a railroad that needed it badly.

Railroad mechanics frequently have a difficult time removing packing from a gland with the conventional packing hook. Here's a tool that seldom fails to do the job. Scarf the end of a 12-in. length of $\frac{1}{4}$-in. welding rod and weld on a large wood screw from which the head has been removed. On the other end, weld a $\frac{1}{4}$-in. rod fashioned into a ring about 2 in. diameter. If you prefer, weld a piece of rod for a T handle. This tool is screwed into the contrary packing, and with a sharp yank on the handle, out comes the packing. Granted, the packing has been destroyed, but this is also usually true when it is removed with the conventional packing hook. These examples illustrate the welder's versatility in making money-saving devices.

Greasing Axle Lathe Centers

Rolling car and locomotive axles with a single roller puts a heavy pressure on the lathe centers. Borrowing the idea from the pressure grease lubricators used on connecting rod ends, the Frascati shop of the Gulf, Mobile and Northern railway in Mobile, Ala., have an effective way of keeping these centers greased.

Taking a short, hollow staybolt, they screw it into one side of the square of both lathe centers for it is a



A grease cup made from a hollow staybolt and brass bushing serves effectively to lubricate centers on a journal-turning lathe

double ended, center drive axle lathe by Putnam. The center has a hole which leads from the staybolt to the point. A long brass bushing is tapped to fit the staybolt and a swiveling handle is fitted to the blank end.

A grease stick is put in the brass bushing which is screwed on the stud. This forces grease to the center and it can't help working back between the axle and the cone point. It has proved a simple and efficient way to prevent undue wear and scored centers.

CHALLENGE TO INDUSTRY'S PATRIOTISM

Calls for Plain Speaking

IT is a pity that the greatest national defense effort in American history had to be made during a presidential election campaign. For a modern defense effort involves an intensely practical industrial project, while an election campaign involves an intensely emotional political propaganda. And those two don't mix.

That, as I see it, is the chief reason for the welter of claims and denials, charges and counter-charges that have been getting in the way of contracts for planes, tanks, guns and all the rest of the armament for which the American people are so nervously peering down the road.

We are told that the managers of industry, smarting and suspicious under the repeated attacks of government officials for some years back, have been reluctant to assume the abnormal risks of defense contracts without commensurate safeguards, and that the politicians who must authorize those safeguards have been reluctant to do anything that might be construed as letting down the bars for unscrupulous business men to exploit the national emergency. For the one, the business risks of full speed ahead have been too great; for the other, the political risks of full speed ahead have been too great. So we don't go full speed ahead.

This is not written to increase that clamor of recrimination on either side. On the contrary, it is an appeal for some decent and thoughtful consideration on the part of all concerned—consideration for the urgent needs of the nation, for the problems and responsibilities of both the politicians and the industrialists, for the elementary principles of prudent business management, and for the good opinion of the man on the street. He is neither a politician nor an industrial executive. But his hide and his pocketbook are at stake in the national defense program—and he knows it. He has a right to the low-down on what is going on. And if he is left in ignorance or deliberately deceived, for the sake of either political or business whoopee, the payoff will be mighty poisonous political medicine for the politicians and equally poisonous business medicine for the business men who may be responsible.

The plain stark fact, to be faced squarely by us all, is that the national defense program is an emergency project—a desperately urgent emergency project.

As in every emergency that confronts a democracy, we are harassed by a confusion of counsel. As always, some of the confusion arises from honest but conflicting judgments, some of it from ignorance or muddy thinking. But, unhappily, much of it reflects the deliberate purpose of self-seekers to fish in troubled waters—to capitalize the conjunction of a national emergency and a political campaign to boost their own interests. Already the charge that American business men are unpatriotic and interested only in profit has been put out as a smokescreen to cover up deficiencies for which business men are in no way responsible.

Now the man on the street finds it hard to see through this maze of excited contradiction. Not because he isn't smart—the average American can think straight enough *when he has the facts.* But in this case the facts are obscure and complicated—they have to do with matters that are strange to him. And to make it worse, at the height of his confusion, raucous voices constantly assail his ear with "simple" explanations of it all. But, as so often happens, most of these "simple" explanations make the matter a lot simpler than it really is.

Consider, for example, the cry that "industry refuses to get busy on national defense until its profits are guaranteed". Very clear and simple, to be sure; but also very false. The charge that American capital is "on strike" in the hour of national need. As silly as it is simple. The assertion that our manufacturers "won't even talk with a government anxious to place orders with them, without large financial concessions", and that "American corporate industry refuses to expand its resources for defense until it receives immunity from proper taxation". The resounding demand that we "conscript wealth as well as men"—whatever that may mean.

Particularly political has been the attack on the aircraft industry. It has been made to appear that aircraft manufacturers were instituting a sit-down strike because, in their greed for profits, they demanded more than 8%. Actually the 8% was not a net profit at all and the only concern of the manufacturers was to fight against incurring losses under the 8% limitation. And army and navy officers have sustained the aircraft manufacturers' viewpoint.

The air is full of explanations which, however simple they may sound, do not explain. And in most cases, I am convinced, the purpose of those who offer them is not to explain but to inflame. Those who try honestly to explain these issues from either side, find it impossible to do the job in such ringing phrases.

As I have said, our country has been caught short. As

a result, there are many reasons for the confusion and controversy. The plain fact is that we can produce our war equipment by only two means: (1) by converting the industries of peace into the industries of war, so far as that is possible; and (2) by building from scratch the new facilities we need to supplement them. In other words, we must create—with desperate haste—a new industry in America—an armament industry.

Right there is the crux of the problem that now confronts the industrialist sincerely trying to equip himself for his part in national defense. For this new armament industry is not the ordinary business risk against which he has learned to weigh the interests of his employees and his stockholders. It does not deal with familiar products and processes. It is not continuous—at least it has not been heretofore in this country—and it may fold up as suddenly as it has opened. It cannot hope to serve thousands of potential customers: it has but one sure customer—the United States Government—and wielding the sovereign power that customer can do just about as it pleases with respect to its needs and demands. Which means that not even this one is a *sure* customer.

No more unfair or deceptive charge ever has been leveled against American industry and American business men than the accusation of being unwilling to take the normal business risks of the defense program. The risks they are trying to minimize—they cannot possibly avoid them all—are very special and extraordinary risks indeed. So clearly is that true, that I doubt very much whether such questions and charges ever would have risen were it not for the fact we are engaged in a political campaign.

Already some of industry's great units have gone ahead with the building of new facilities, the purchase of special materials, and the actual production of armament in the face of all risks, gambling that their government eventually would work out some reasonable plan to protect them against excessive loss. Others, doubtless will follow suit.

But many other companies, for one reason or another, are not in position to do that. So before they begin to expand their facilities to handle defense contracts, they have asked their *only potential customer for those new facilities* to guarantee them—*not* excessive prices, *not* exorbitant profits, *not* immunity from taxation, as we are being told, but simply against the excessive losses that may result from very extraordinary conditions.

As this is written, it looks as though the legislation and the rulings necessary to accomplish this purpose soon will be forthcoming. Thoughtful and responsible officials of the government understand the situation and what is needed. But, unfortunately, their understanding and action will not quiet the professional business-baiters. So long as those gentlemen have their own interests to serve, so long as political excitement makes it easy to whip up public demand for a scapegoat to atone for disappointing progress with the defense program—just so long will the business-baiters find a receptive audience for their criticisms.

All of which suggests that business men must carry at this time a double responsibility, in addition to their obvious obligation to do the very best job they know how on their individual parts of the defense program.

The first of these added responsibilities is, of course, to avoid any possible basis for the charge that industry is exploiting the defense program in behalf of excessive profit, unfair treatment of labor or any other unworthy self-interest. The second is to see that the man in the street knows and understands all that I have tried to set down in the foregoing.

For the man in the street is deeply involved in all this. He is "in the street" only to the political orators. To the rest of us, he is the man in the factory, the man on the truck, and the man behind the orders that industry fills. In short, he makes up this living American industry on whom the politician's charges spatter. As an employee he has a stake in the solvency, the security, and the reputation of the very plants at which criticism may be directed. Knowing the facts, he can answer the critics so far as his own plant is concerned and can see how the same kinds of facts apply to all industry. If he is a customer, suffering inconvenience as a result of the plant's service to national defense, a knowledge of the facts behind the plant's problems will help to make him a defender rather than a critic of responsible business management. If he is a neighbor in the community, the facts will equip him to be an interpreter of industry's problems to the people of the home town.

In this national defense effort, business enters into a new partnership with government, but, more importantly, into a deeper partnership with the American people. It is more than ever essential that it take all of the American people into its confidence, beginning with the people in its plants and going out through the ranks of its customers and its community neighbors to show them that they have a common interest in seeing that the task of national defense is undertaken in the American way.

As we all know, there are in this country some people who would like nothing better than to see American industry fail in this supreme test of service to the nation. They will watch with jealous eyes every move of every company that is engaged on a defense job. They will disparage its achievements, exaggerate its shortcomings, and distort its motives. For they would like to make over American industry to their own pattern, and they'll never have a better chance to get started with it than has been opened up by the national emergency. Or so it looks to them.

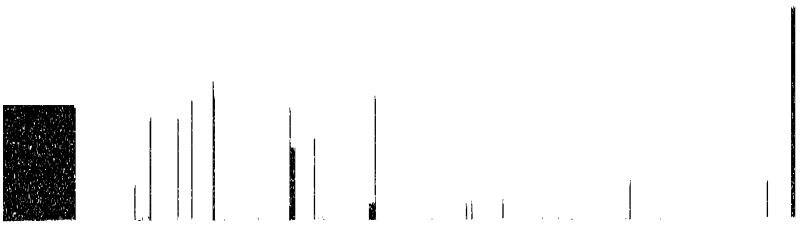
So, great as are the business hazards of the defense program for the individual business man, even greater hazards are involved for American industry as a whole. But, knowing the temper of American industrial leadership as I do, I am confident that it will handle its defense assignment with credit to itself and with great advantage to the nation that it serves—whether in war or in peace.

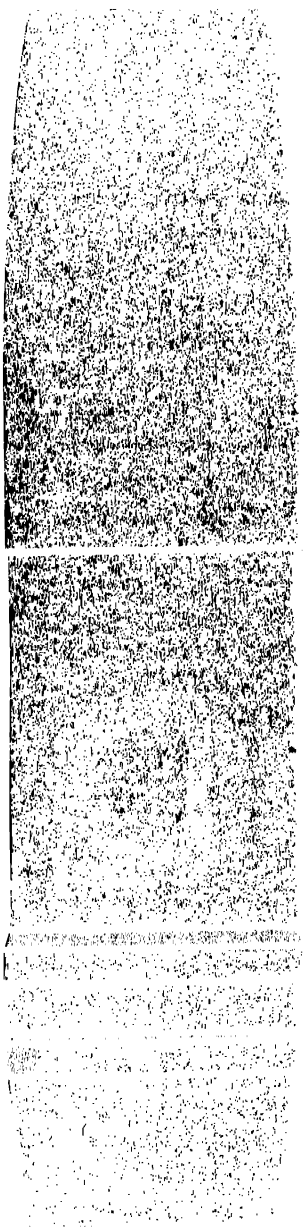
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HOW TO MACHINE

5 MM

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A PRACTICAL WORKING MANUAL DESIGNED TO GUIDE PRIVATE INDUSTRY IN TOOLING UP FOR THE MANUFACTURE OF SHELL

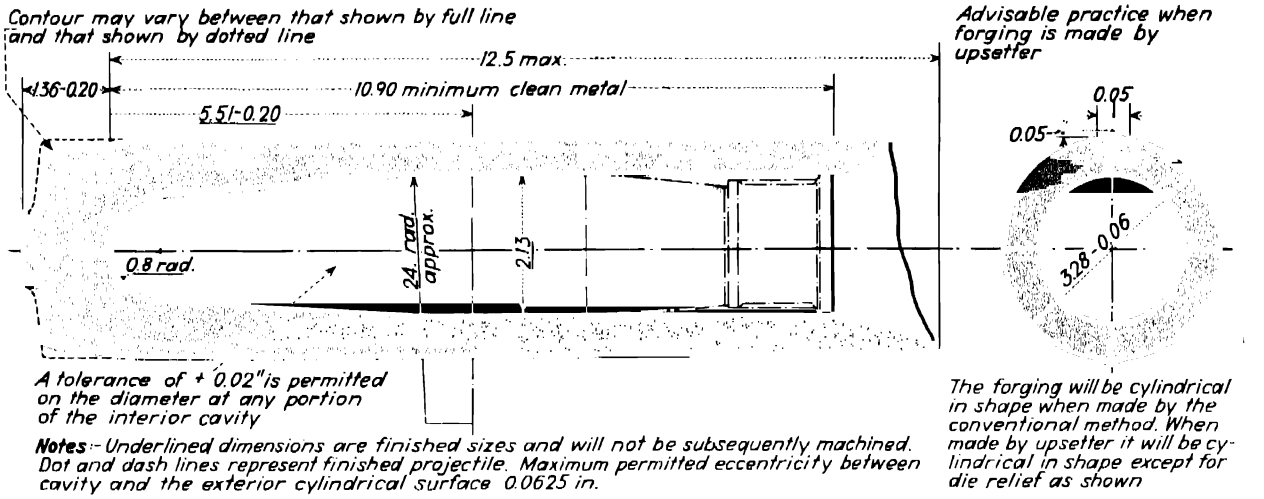
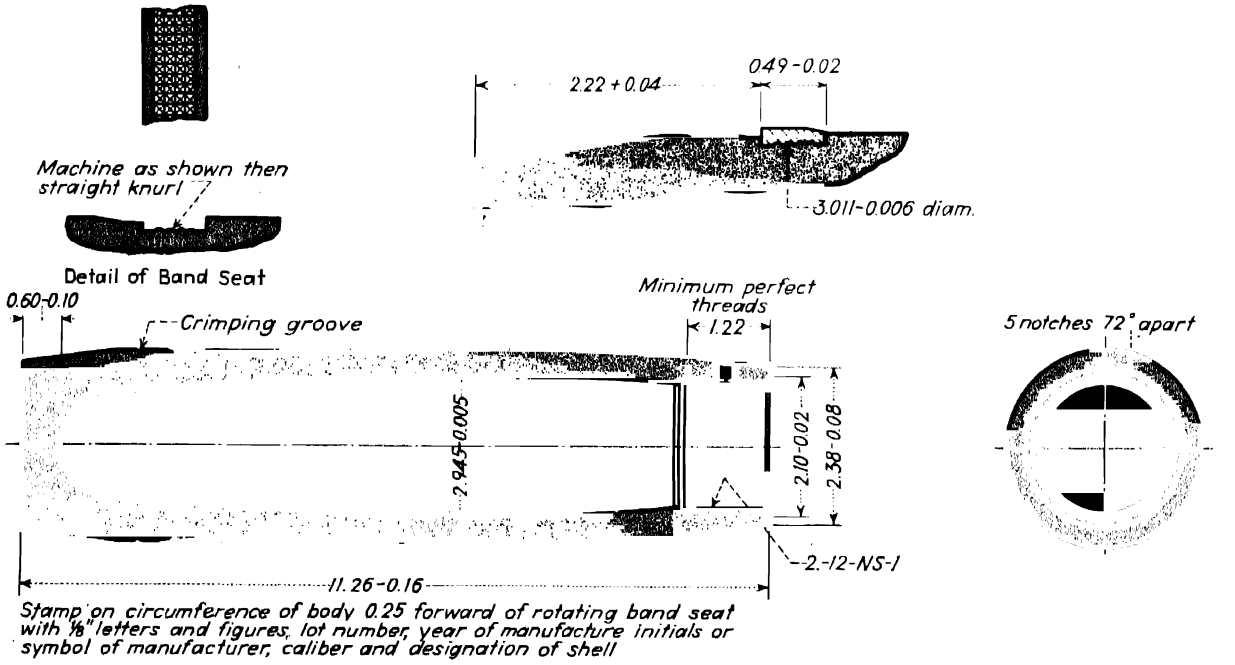


FIG. 1—*The shell forging is made of SAE X1340 steel with the following minimum physical properties: yield point 55,000 lbs. per sq. in., elongation in 2 in., 15 per cent; reduction of area, not less than 30 per cent*



Note:- Shell must be carefully centered during the various machining operations, in order to maintain concentricity of cylindrical surfaces. The following max. eccentricities of cylindrical surfaces will be accepted
1. Between fuze seat or adapter seat threads and outside cylindrical surface, 0.015
2. Between bourrelet and rotating band, with shell body, 0.006 (bourrelet must overlap body on entire circumference)
3. Between cavity of shell and and outside cylindrical surface, 0.015
4. Between base cover and base of shell, 0.03

FIG. 2—*The completely machined shell has a gliding metal rotating band rolled into the knurled seat and a No. 22 gage cover seam welded to the base. It weighs 10.97 lbs. empty as against 20 lbs. maximum for the forging*

HOW TO MACHINE 75-MM. SHELL

This is the first of a special series of authoritative articles describing the manufacture of armament and other products needed for national defense

BY CHARLES GRAZIOSO

Chief Engineer, Artillery Ammunition Division, Frankford Arsenal

FRANKFORD ARSENAL'S set-up for machining 75-mm. shells is a good example of the way in which the Ordnance Department contributes to the technique of munitions manufacture. The arsenals, unless expanded to extravagant proportions, can never be more than pilot plants, which would supply in war time only a small percentage of the country's munitions requirements. They serve, however, to keep alive the art of munitions making during peace time; they furnish a source of supply of ordnance materiel; and they are models for private manufacturers working on ordnance orders.

This article discloses for the first time details of modern tooling for the 75-mm. shell. It gives the findings of 2½ years of intensive study by the Artillery Ammunition Division, Frankford Arsenal, on the application of present-day machine tools to this size of projectile. The presentation is designed to be a practical working manual for private plants called upon to make shells.

The 75-mm. shell was selected for this treatment because it is the size of artillery ammunition made in the greatest quantity and because of all ordnance items, shell manufacture is subject to the most drastic expansion during an emergency. Many of the machining operations performed on this shell are similar to those used on larger and smaller sizes.

An idea of the contribution made by the Ordnance Department to the technique of manufacture may be gained by the fact that it is now possible to make 3000 shells per 8-hr. day with only 41 machine operators. This is not theoretical, but a statement of Frankford Arsenal's actual performance. Machine tool investment for this output is slightly more than $500,000.

Credit for development of these methods goes to the personnel of the Artillery Ammunition Division, Frankford Arsenal, to machine tool and small tool manufacturers and especially to Lieut.-Col. L. H. Campbell, Jr., formerly officer in charge of this department, and now on duty in the office of the Chief of Ordnance, Washington, D. C.

Shell forgings, Fig. 1, are made by commercial forging plants, either by the conventional pierce and draw-bench method or by means of an upsetting machine. The steel is equivalent to SAE X1340. The forgings are furnished to meet specified physical properties: yield point—not less than 55,000 lb. per sq. in.; elongation in 2 in.—not less than 15 per cent; reduction of area - not less than 30 per cent. Main-

tenance of these physical properties in the forging avoids the heat-treatment during the machining operations that was formerly practiced. This arrangement has resulted in a great saving in time and equipment, and has eliminated one of the choke points in shell manufacture.

Another great saving is the making of forgings with the interior cavity corresponding to the finished shell dimensions, Fig. 2, thus eliminating boring operations to machine this cavity to size. The boring operations proved to be another choke point during the last World War.

The first operation to be performed at Frankford Arsenal is to shot blast the interior surfaces of the forging to remove all scale. The forging is then ready to start its journey through the machining department.

Special Mandrel for Centering

Centering is the second operation; it must be carefully performed to insure concentricity within the limits of specification as all succeeding operations are dependent upon it. To center, the forging is placed on a six-jaw expanding mandrel, hydraulically or air-operated as shown in Fig. 3. The three jaws at the end of the centering arbor grip the interior of the forging first, as they are positively actuated. The three jaws at the rear of the mandrel are controlled by an equalizing spring which compensates for any draft in the interior forging dimensions. The expanding jaws are made from 0.90 carbon tool steel and hardened; they are ground in place after the mandrel has been fitted to the machine spindle, insuring accuracy in the working position. The centering arbor body and other details are made from high grade chrome-nickel steel which is heat-treated. The arbor is tested daily by means of an accurately finished master shell, using a dial indicator to check the concentricity of the outside surfaces. The forging is rotated in the machine counter-clockwise while the centering drill is rotated clockwise.

The third operation is that of machining the base, cutting off and turning for concentricity. This operation is performed on a multi-tool lathe with a swinging tailstock as follows: The forging is chucked on a three-jaw expanding arbor locating from the cavity, while the tailstock is swung into position in the center as shown in Fig. 4. A convenient feature of the set-up used at Frankford Arsenal is a work shelf that fits on the swinging tailstock. When the tailstock is swung backward out of position, the shelf comes into line with the expanding arbor affording a handy means of unloading and reloading the work.

The tools used in this operation, namely the driving arbor and jaws, are manufactured from chrome-nickel steel and 0.90 carbon tool steel respectively. Three carbide turning tools are located on the front slide of the machine, and two additional carbide tools are mounted in the back arms—one for base facing, and the other for cutting off the excess stock from the open ends.

The fourth operation is known as "nosing-in the open end." This operation is done by cold pressing in a crank press of 180-ton capacity with a 16-in. ram. The shell is placed in the collet and die set, shown in Fig. 5. The ram of the press descends upon the open end of the shell, and the collet is clamped around the shell as soon as the upper part of the die strikes it. The collet bottoms on a sleeve to limit its motion, while the die forms the nose of the shell to produce the correct inside radius. The die is made from steel which can take abuse without scoring and is banded by a machine steel ring to prevent shattering. Tallow is used as a lubricant in this operation.

The fifth operation is to finish turn the exterior surfaces of the shell. This operation is performed on a vertical two-slide turning machine with form plates on each slide to guide the tools so that the correct exterior contour is produced. A locator is placed in the shell and then both shell and

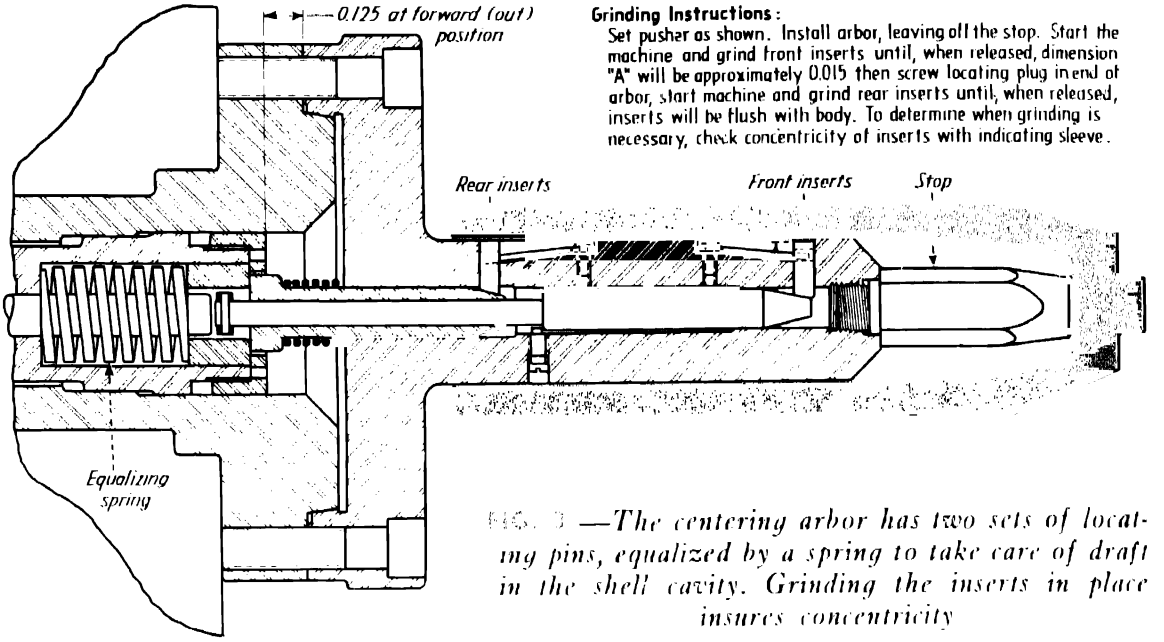


FIG. 3 —*The centering arbor has two sets of locating pins, equalized by a spring to take care of draft in the shell cavity. Grinding the inserts in place insures concentricity*

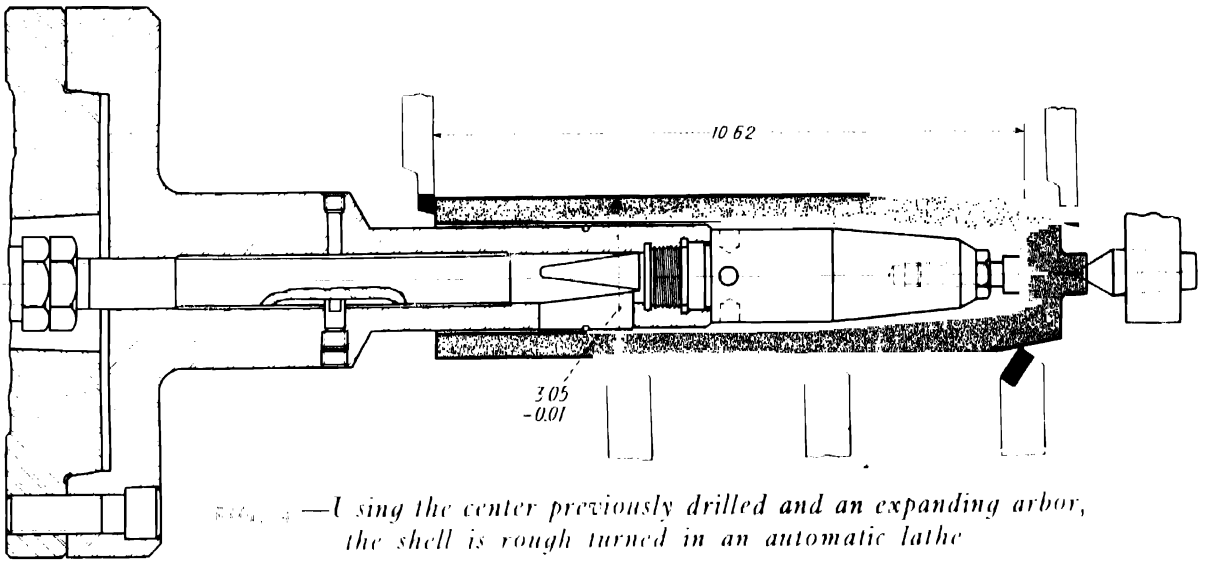


FIG. 4 —*Using the center previously drilled and an expanding arbor, the shell is rough turned in an automatic lathe*

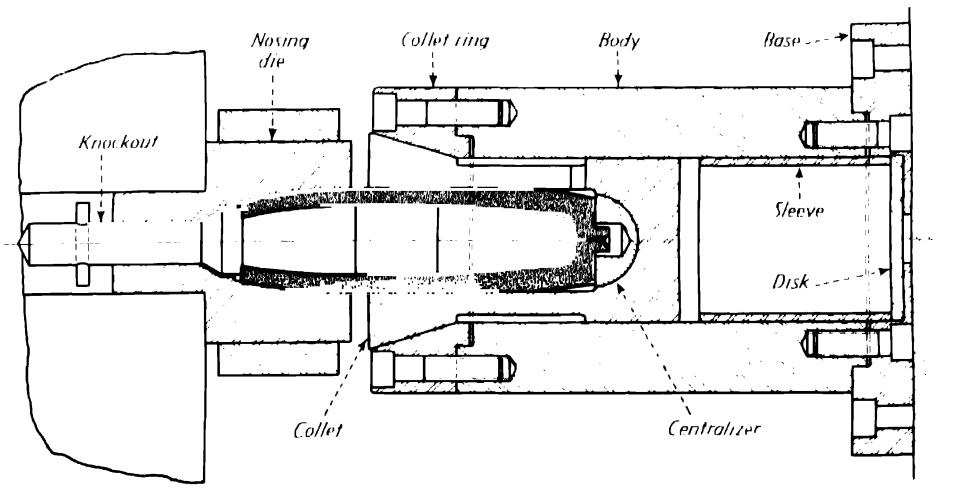


FIG. 5 —*The nose of the 75-mm. shell is cold formed in a crank press while held in a vertical collet*

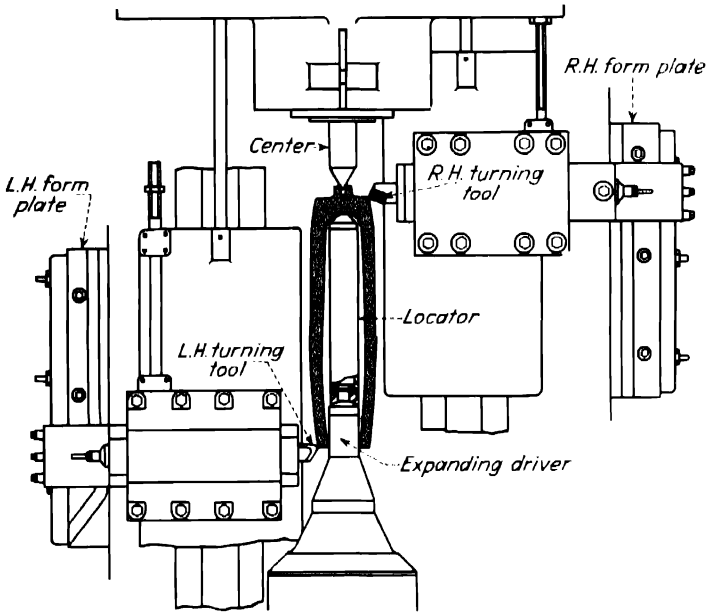


FIG. 6—*Finish turning the O.D. is done in a vertical lathe which uses two carbide tools feeding upward and downward respectively*

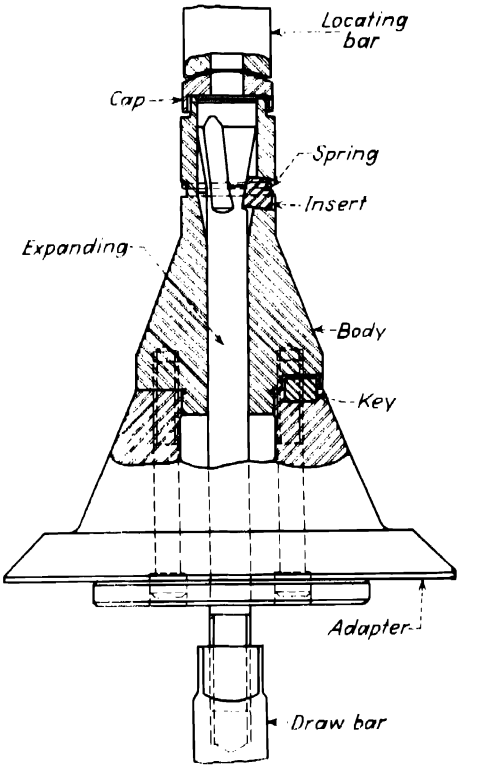


FIG. 7—*Details of the driver used on the vertical lathe shows the locating bar, which fixes the height, and the expanding inserts. The base of the shell is supported by a dead center moved downward hydraulically*

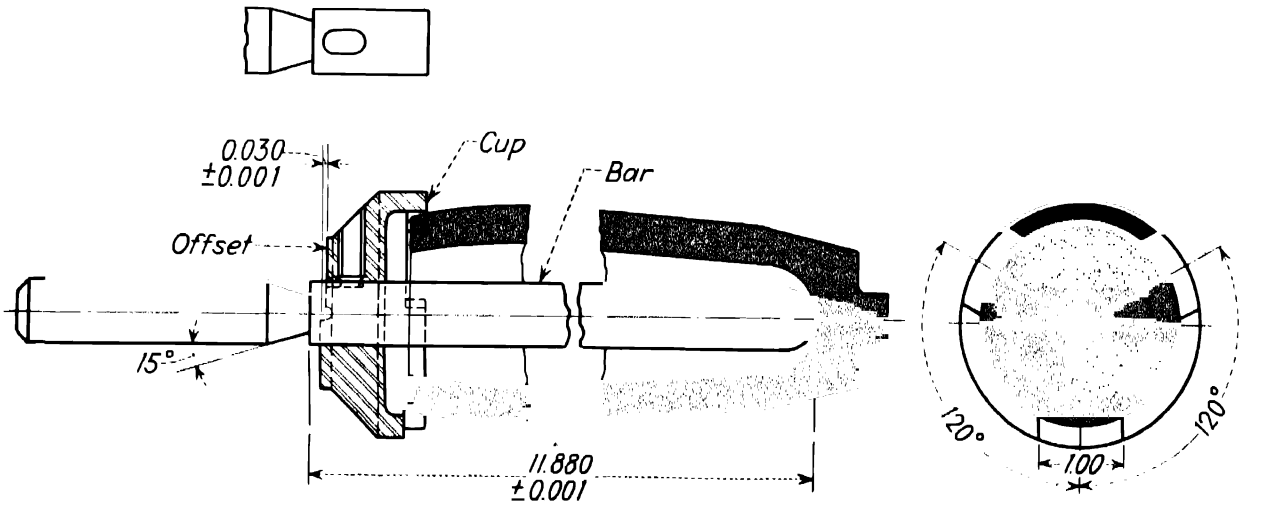


FIG. 8—*A special gage shows whether the O.D. at the point of final trim is the correct distance from the base of the cavity. The cup is loosely held on the gage bar, the shoulder of which must fall within the 0.030 in. offset when the cup is in contact with the work*

locator are placed over the expanding driver. Expanding inserts, in the driver, chuck the inside contour of the shell while the tailstock is automatically brought into position. Both expanding driver and tailstock are hydraulically operated. This method of chucking locates the work from the bottom of the cavity.

The right and left-hand turning tools are then fed along the shell following their respective forming plates as shown in Fig. 6. A cross-section view of the driver is shown in some detail in Fig. 7. The gage, Fig. 8, locates from the interior of the cavity to measure the diameter across the nose at a point where the shell is subsequently faced. This gage consists of a bar with a spherical end, which strikes the bottom of the cavity, and a loosely supported ring with three contact points which rest upon the outside diameter of the shell a short distance from the nose. The back of this ring is offset over half its area. A shoulder in the plug must fall within the upper and lower limits of this offset, a distance of 0.030 in., in order to have the work pass inspection.

Operation No. 6 is that of drilling and tapping the lock screw hole. This operation is performed in a two-spindle drill press with the shell located from the inside bottom on a sliding jig shown in Fig.

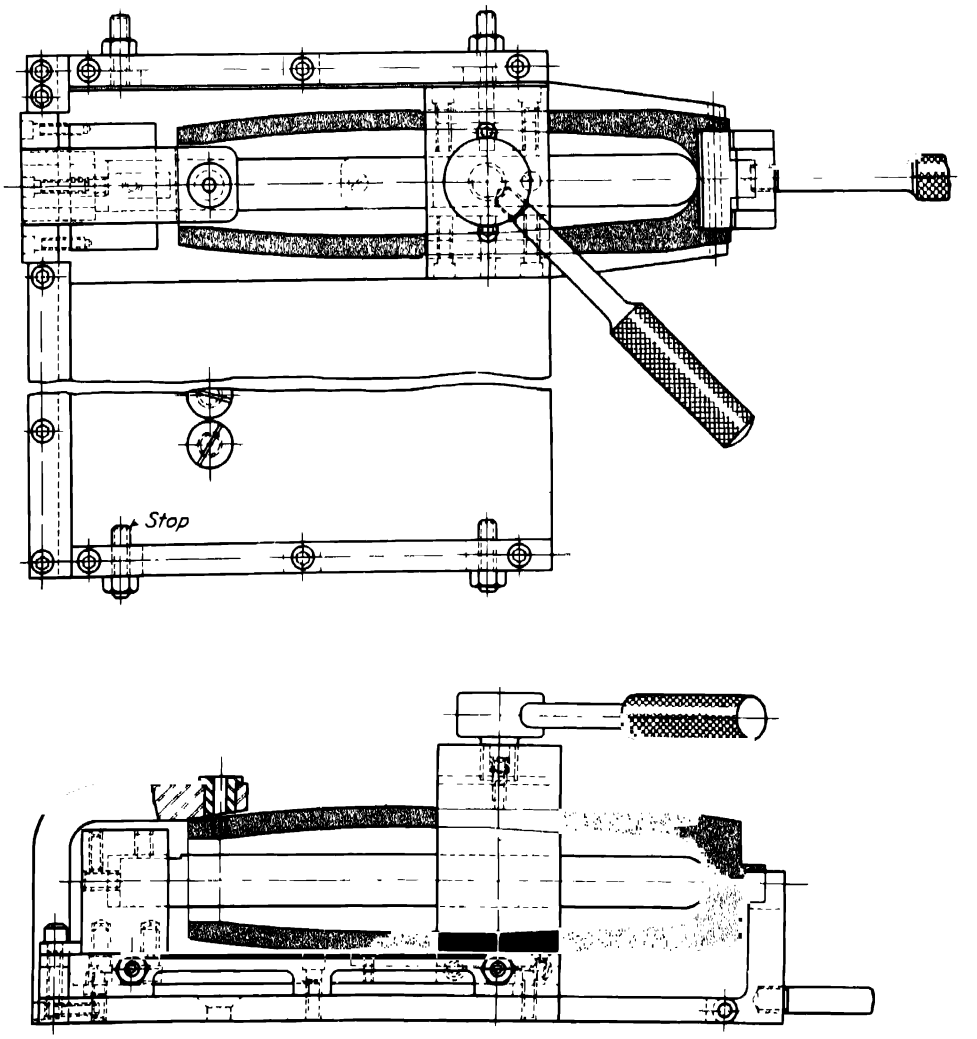


FIG. 9—*After being drilled in the position shown the shell is moved in its jig against the opposite pair of stops for tapping the set screw hole*

9. Drilling is done with a size G drill through a fixed bushing. Then the locating portion of the jig is slid along the base plate against a pair of stops which brings the hole directly beneath the tapping spindle. A hand fed floating tap cuts the 18-pitch lock-screw hole with the use of a tapping attachment. The only thing to remember in connection with this operation is that it should be performed before cutting the larger thread which forms the fuze seat. If the lockscrew hole is cut after the larger thread it will raise a burr that is difficult to remove.

Finished on Multi-Spindle Machine

The seventh operation entails finish machining both ends of the shell. It is performed on an eight-spindle double indexing machine. The shell is placed in the eighth station, locating from the base of the cavity and chucked on the outside diameter. It is then indexed to Station 2, where a carbide tool rough faces the base; then to Station 4 where an end mill machines the lug to the rough face base thickness; meanwhile, a carbide form tool forms the band seat grooves and the cartridge case crimping groove. At Station 6, the base of the shell is finish faced to the correct specified thickness. These operations are illustrated in Fig. 10.

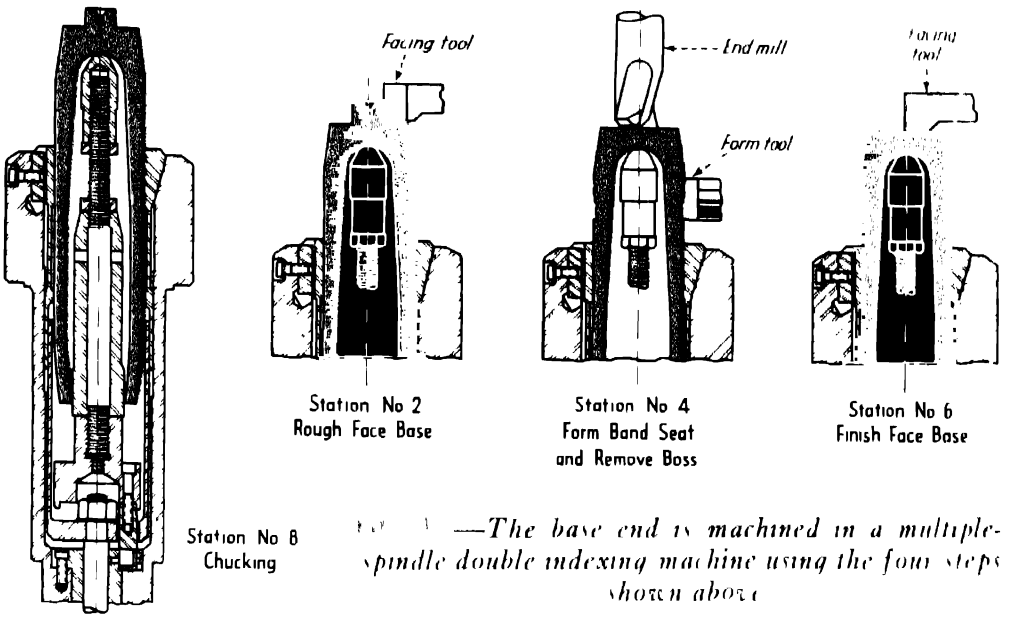
After the shell is machined on the base end, it is removed from the chuck in the eighth station; it is inverted and placed in Station 1 with the open end out, where it is located from the outside base and chucked on the outside diameter. At Station 3 the open end is rough bored and rough faced; at Station 5 the open end is reamed to 1.9098 plus 0.0090 in. diameter, making the shell ready for the tapping operation. In this position the open end is chamfered by a carbide tool. At the last station of this machine, the shell mouth is finished faced to the correct depth and tapped with a collapsible tap. Fig. 11 shows the machining up to this point.

The device, shown in Fig. 12, is used throughout the machining operations in order to insure that concentricity is maintained in the shell. It consists merely of a pair of rollers and a finger-type indicating gage. As the shell is rotated on the rollers, any runout becomes at once apparent. A slide permits the shell to be placed at various positions in order to check different points along cavity.

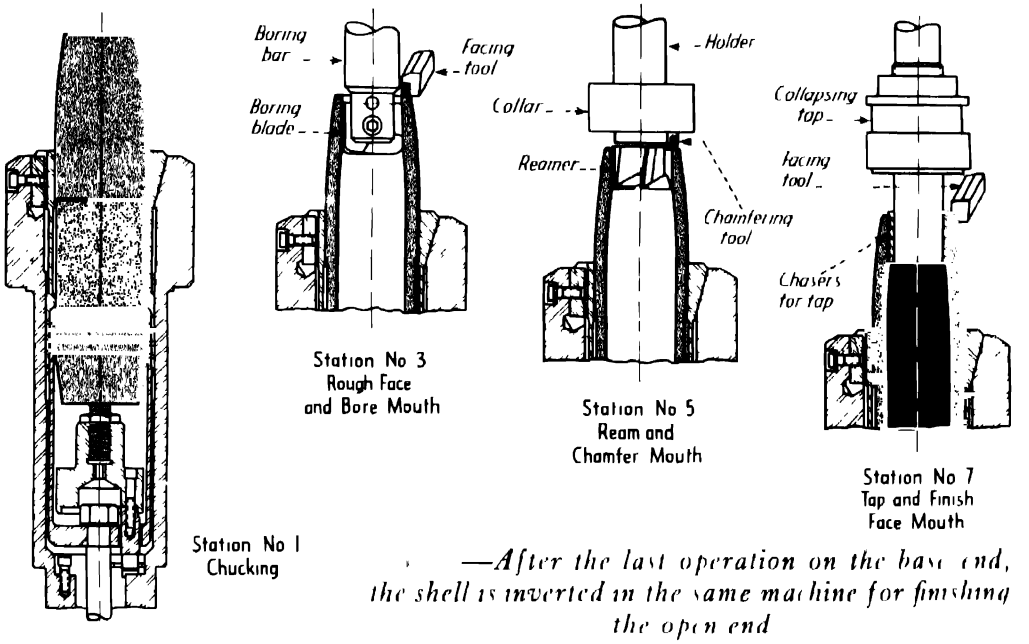
Notching is done next on the fixture shown in Fig. 13. This work is done on a hand feed milling machine. The shell is placed in the notching fixture and is chucked by rotating handwheel *A* clockwise until tightened. Then feed handle *B* is brought forward bringing the table against the stop, while the notching cutter *D* cuts the first notch. The feed handle is then brought back, and the indexing trip lever is brought forward to permit rotation of the chucking handle *A* so the next notch may be made. This is continued until all five notches have been cut 72 deg. apart.

The shell is next stamped with the year of manufacture, the size and style of projectile, and the initials of the manufacturer, such as 75 MM. HE. M48-1940 FA. Stamping is done on a machine having two idler rolls which support the shell while a circular stamp in the ram of the machine is brought in contact with the outside diameter. The ram is operated by a foot pedal. The circular die is power-driven and rotates the shell while the lettering is pressed into it by a set-up shown diagramtically in Fig. 14.

Next comes knurling the band seat, the tenth operation. Annular grooves have already been cut in the band seat by means of the form tool used in operation No. 7. In this operation the longitudinal grooves are cut giving a square knurled pattern. The work is done in the set-up shown in Fig. 15. The shell is placed in a revolving rest while the two knurling rollers are brought into contact with it by pneumatic control. This in turn presses the revolving shell in contact with the working knurl which does the cutting. About eight to ten revolutions of the shell, while in



—*The base end is machined in a multiple-spindle double indexing machine using the four steps shown above*



—*After the last operation on the base end, the shell is inverted in the same machine for finishing the open end*

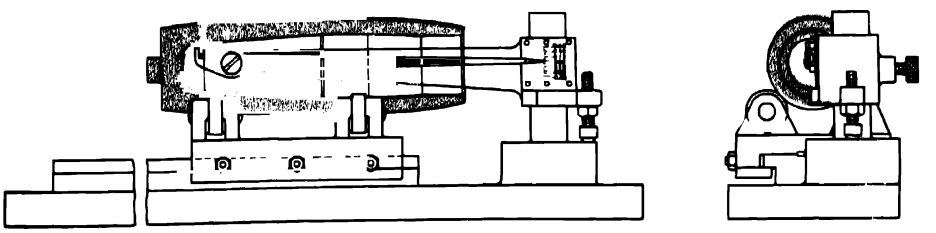


FIG. 11—*Shells are inspected in this fixture after rough and finish turning to determine the degree of runout. In this way uniform wall thickness is obtained*

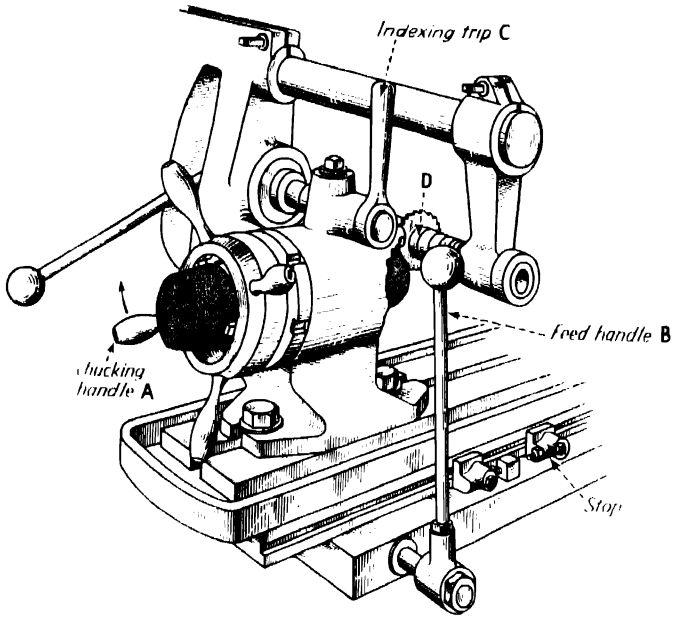


FIG. 13—*Five staking notches are cut with the shell held in this fixture on a hand-feed milling machine. The work is clamped and indexed by hand*

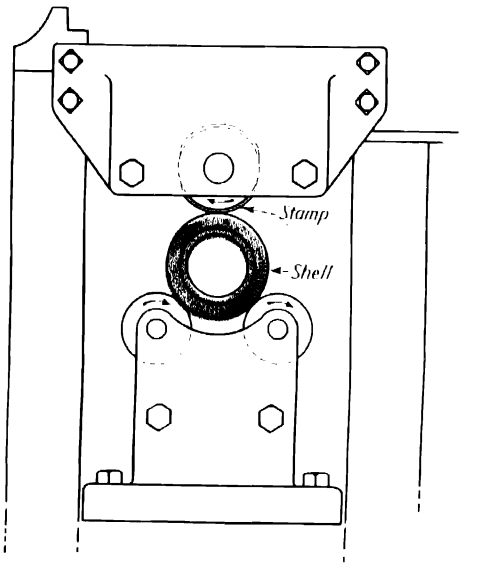


FIG. 14—*An identifying stamp is rolled on the outside of each shell just above the band seat. Pressure between the shell and revolving stamp is applied by means of a foot pedal*

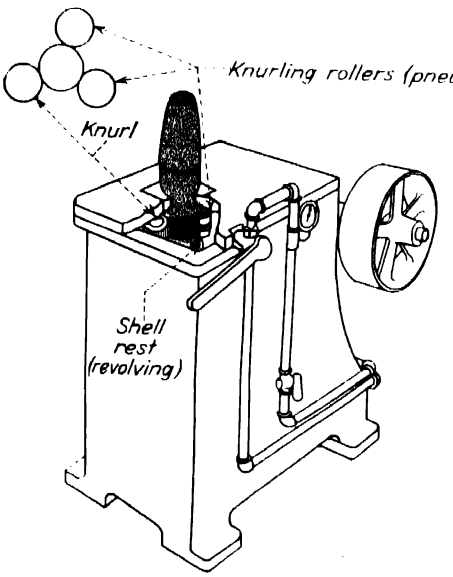


FIG. 15—*Longitudinal grooves in the band seat are cut across the annular grooves machined during the turning operation to form a right-angle knurled pattern*

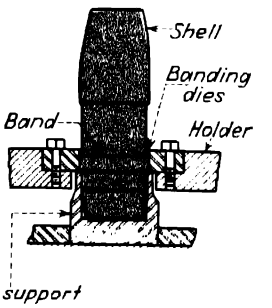


FIG. 16—*The shell is gripped in three positions in a tire setter while a pressure of 900 lbs. applies the gilding metal band to the knurled seat*

contact with the knurling tool, is required for this operation.

Operation No. 11, shown in Fig. 16, consists of pressing the rotating band into place. The gilding metal band is slipped over the shell and located at the band seat. Shell and band are then placed in a hydraulic press equipped with six dies to press the band into place. The dies are applied until a gage pressure of 900 lb. is reached, which is held approximately 3.2 sec.; the pressure is then released to permit the dies to return to neutral position. The shell is then rotated about 15 deg., and the same pressure is applied for the same amount of time. This procedure is followed three times to insure that the gilding metal band has completely filled the band seat. Periodically a band is removed for visual inspection to make certain that the metal is flowing correctly.

The twelfth operation is that of turning the band. This is done by placing the shell in a collet held in the hollow spindle of a lathe, locating from the outside base by means of a swinging stop. The carriage holding the carbide turning tool then rough turns the band which is followed by the finish turning tool. A form tool in the cross-slide puts the grooves in the band and trims it to width. A semi-automatic machine is used in this operation as shown in Fig. 17.

The thirteenth operation is welding the base cover. This consists merely of a bright soft annealed circular disk of sheet steel, SAE 1015 and No. 22 U.S. gage. It is designed to reinforce the base of the shell against the force of the explosion. The base cover is welded in place by either overlapped spot-welding or seam welding. Fig. 18 shows the seam welding set-up with two fixtures, one of which is loaded, while the other is in working position. Two welding wheels make it necessary to turn the work through only 180 deg. in order to obtain a finished continuous weld.

The last step is washing the shell to remove all oil and grease, and to prepare a surface so that paint will adhere without peeling. Dimensions on the outside diameter are checked at seven points simultaneously by means of an Electrolimit gage. The threaded fuze seat is inspected by means of a plug gage mounted on a rebuilt tapping attachment which drives the plug by friction and reverses the direction of rotation as the work is pushed on and off. All other important dimensions are checked by individual gages. This inspection is performed 100 per cent on all shells.

Following inspection, the setscrew is screwed into position, and the threads are greased. Then both exterior and interior surfaces are painted in spray booths to prevent rusting. Six shell are placed in a carton for shipment.

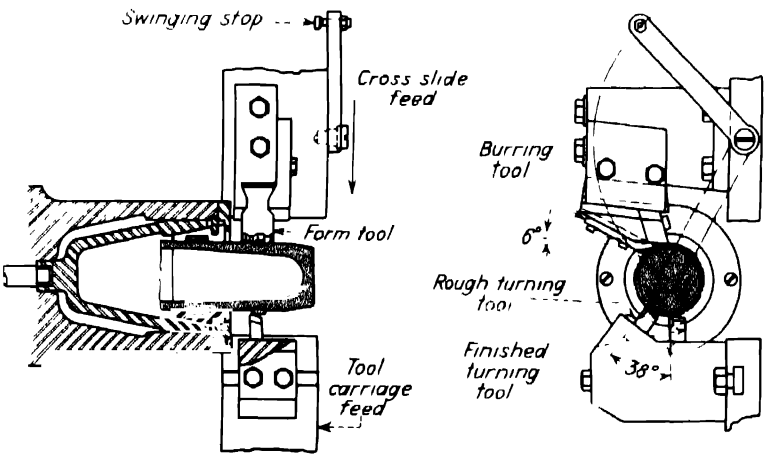


Fig. 17—After being pressed into place, the band is rough and finish turned and trimmed in a hollow-spindle semi-automatic lathe

It is possible to use machines made by a number of different manufacturers for each of the steps outlined above. At present the Frankford Arsenal is employing the machines given in the following tabulation. It should be remembered, however, that these are not the only methods that can be employed for the work of producing 75-mm. shell. One alternative is to use lower production general-purpose machines as was done to a large extent during the last World War.

Developments in shell manufacture have not reached an end. The Ordnance Department is continuing experiments with materials and methods that may cause important changes in the future. However, the operations described here represent the best practice that has been devised to date.

The views expressed in this article are those of the author and in no way reflect the attitude of the War Department. Statements made and figures quoted are not from official sources.

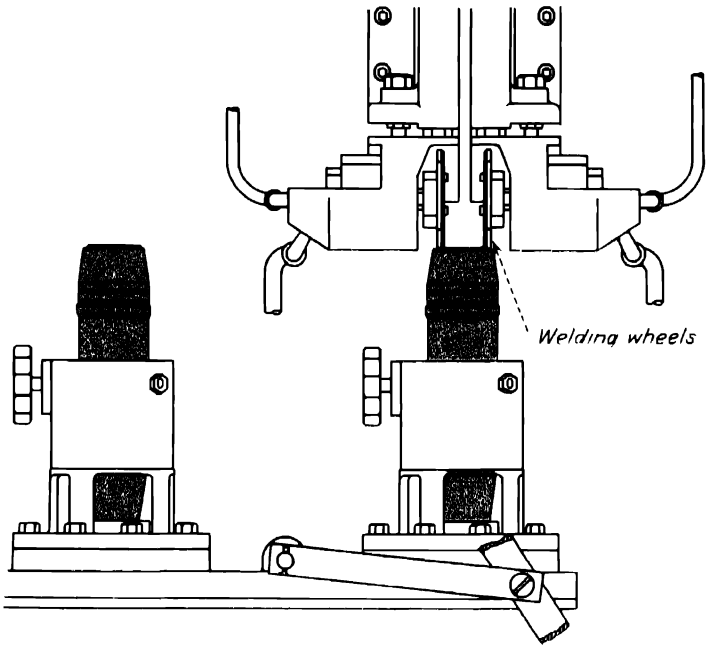


FIG. 18—*The base cover is welded in place by a seam welder using two holding fixtures. Overlapping spot welds are also acceptable*

75 MM. 1148 H.E. SHELL

BASED ON PRODUCTION OF 3,000 SHELL PER EIGHT-HOUR DAY

FINISHED FORGED CAVITY

Operation Number	Operation	Machine	Production per Machine (8 hr.)	Machines Required	Operators Required
1	Shotblast	Pangborn	1000	3.00	3.00
2	Center	Foster	1000	3.00	3.00
3	Cut-off, rough turn and face base	Fay Automatic	360	8.33	8.33
4	Cold Nose	Bliss No. 87 Crank Press	1300	2.31	2.31
5	Finish turn	Ex-Cell-O	535	5.61	5.61
6	Drill and tap set screw hole	Bodine	3000	1.00	1.00
7	Finish both ends and band seat	New Britain	600	5.00	5.00
8	Notch	Producto-Matic	1650	1.82	1.82
9	Stamp	Noble & Westbrook	3300	0.91	0.91
10	Knurl	Morley	3300	0.91	0.91
11	Apply band	West Tire Setter	1000	3.00	3.00
12	Turn band	Sundstrand	1000	3.00	3.00
13	Weld base cover	Thomson-Gibb Seam Welder	1000	3.00	3.00
		Total	...	40 89	40 89

Tap Standards

THE AMERICAN STANDARDS ASSOCIATION has approved a standard for cut and ground thread taps. It includes a standard table for markings, thread and general dimensions, and working tolerances for hand taps, machine screw taps, taper taps, nut taps, pulley taps, boiler taps, mud- or washout-hole taps, staybolt taps, pipe taps, and combined pipe tap and drill.

The form of thread profile specified is known as the "American National Form." The basic angle of thread between the sides of thread measured in an axial plane is 60 deg. The line bisecting the 60-deg. angle is perpendicular to the axis of the screw thread. The basic depth h of the thread form is found as follows:

$$h = 0.649519p = 0.649519/n$$

The basic pitch diameter is the number obtained by subtracting the single thread depth from the basic major diameter, i.e.

Basic pitch diameter $= D - h$

where D = major diameter, h = depth of thread, n = number of threads, and p = pitch of thread.

Tap markings include the nominal size, number of threads per inch, and the proper symbol to identify the thread form,* which symbols are:

NC—American standard coarse thread series.

NF—American standard fine thread series.

N—American standard 8-pitch, 12-pitch and 16-pitch series.

NS—Special threads with the American national form.

NH—American national hose coupling threads.

NPT—American standard taper pipe threads.

NPS—American standard straight pipe threads.

NPSG—A standardized undersize straight pipe thread for grease cup fittings.

V—A 60-deg. V-thread usually with both the crest and root flatted several thousandths from the theoretical to users specifications.

Acme—American standard 29-deg. acme-type thread.

* Such markings as U.S.S., U.S.F., S.A.E., and A.S.M.E. are now obsolete.

The American standard coarse thread series includes the following sizes and pitches:

No.	1–64 NC	$\frac{3}{8}$"	16 NC	$1\frac{1}{2}$"	6 NC
No.	2–56 NC	$\frac{7}{16}$"	14 NC	$1\frac{3}{4}$"	5 NC
No.	3–48 NC	$\frac{1}{2}$"	13 NC	2 "	$4\frac{1}{2}$ NC
No.	4–40 NC	$\frac{9}{16}$"	12 NC	$2\frac{1}{4}$"	$4\frac{1}{2}$ NC
No.	5–40 NC	$\frac{5}{8}$"	11 NC	$2\frac{1}{2}$"	4 NC
No.	6–32 NC	$\frac{3}{4}$"	10 NC	$2\frac{3}{4}$"	4 NC
No.	8–32 NC	$\frac{7}{8}$"	9 NC	3 "	4 NC
No.	10–24 NC	1 "	8 NC	$3\frac{1}{4}$"	4 NC
No.	12–24 NC	$1\frac{1}{8}$"	7 NC	$3\frac{1}{2}$"	4 NC
	$\frac{1}{4}$"–20 NC	$1\frac{1}{4}$"	7 NC	$3\frac{3}{4}$"	4 NC
	$\frac{5}{16}$"–18 NC	$1\frac{3}{8}$"	6 NC	4 "	4 NC

The American standard fine thread series include:

No.	0–80 NF	No.	10–32 NF	$\frac{5}{8}$"	18 NF
No.	1–72 NF	No.	12–28 NF	$\frac{3}{4}$"	16 NF
No.	2–64 NF	$\frac{1}{4}$"	28 NF	$\frac{7}{8}$"	14 NF
No.	3–56 NF	$\frac{5}{16}$"	24 NF	1 "	14 NF
No.	4–48 NF	$\frac{3}{8}$"	24 NF	$1\frac{1}{8}$"	12 NF
No.	5–44 NF	$\frac{7}{16}$"	20 NF	$1\frac{1}{4}$"	12 NF
No.	6–40 NF	$\frac{1}{2}$"	20 NF	$1\frac{3}{8}$"	12 NF
No.	8–36 NF	$\frac{9}{16}$"	18 NF	$1\frac{1}{2}$"	12 NF

In addition to the regular marking, bent-shank tapper taps with cut threads are marked "Class 2" while those with precision commercial ground threads are marked "Class 3."

Special taps (except ground thread taps marked with limit numbers stipulated later) varying only slightly from standard dimensions are marked with the letter S in a circle.

Taps varying on the pitch diameter up to 0.015 in. over or under basic are marked with the actual amount the low limit is over or under the basic size, and standard size.

Fractional size taps with commercial ground threads and machine screw taps with either commercial or precision ground threads are marked with one ring on the shank near the thread in addition to the standard marking.

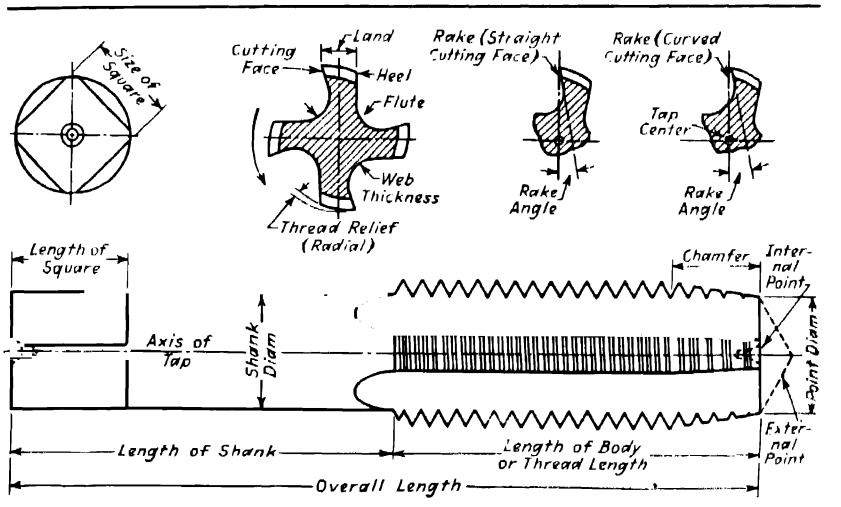
Precision ground thread taps having a pitch diameter between basic and minus 0.0005 are marked with "01." Those having a pitch diameter between basic and plus 0.0005 are marked with "1." Those with a pitch diameter between 0.0005 to 0.0010 over basic are marked "2."

Ground thread pipe taps are marked "CG" if the pitch-diameter grinding tolerance is equal to or greater than the following values (they are marked "PG" if it is less):

4 to $5\frac{1}{2}$ threads per in. incl.	0.0020 in.
6 threads per in.	0.0018 in.
7 threads per in.	0.0015 in.
8 threads per in.	0.0014 in.
9 threads per in.	0.0014 in.
10 and $11\frac{1}{2}$ threads per in.	0.0011 in.
12 threads per in. and finer	0.0010 in.

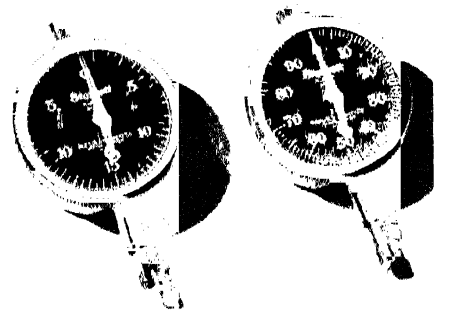
Taps and dies having multiple threads are marked with (1) diameter, (2) number of threads to the inch, (3) form of thread, (4) lead designated in fractions, and (5) double, triple or quadruple. For example a 1-in., 16 double-thread special tap is marked:

1"—16NS
$\frac{1}{8}$ Lead Double



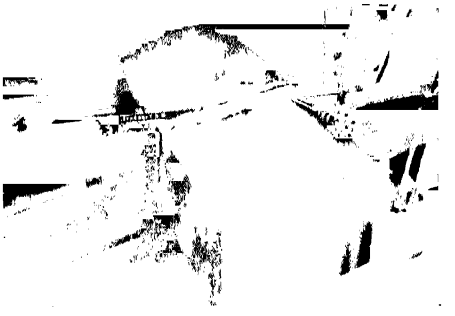
Tap terms adopted as standard by the American Standards Association





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Tap Standards

AMERICAN NATIONAL FORM THREAD LIMITS

Fractional Size Taps Cut Thread

Size	Threads per Inch			Major Diameter			Pitch Diameter		
	NC	NF	NS	Basic	Min	Max	Basic	Min	Max
1/16			64	0.0625	0.0635	0.0650	0.0524	0.0526	0.0536
3/32			48	0.0938	0.0951	0.0966	0.0803	0.0805	0.0815
1/8			40	0.1250	0.1266	0.1286	0.1088	0.1090	0.1105
5/32			32	0.1563	0.1585	0.1605	0.1360	0.1365	0.1380
5/32			36	0.1563	0.1580	0.1600	0.1382	0.1384	0.1399
3/16			24	0.1875	0.1903	0.1923	0.1604	0.1609	0.1624
3/16			32	0.1875	0.1897	0.1917	0.1672	0.1677	0.1692
7/32			24	0.2188	0.2216	0.2236	0.1917	0.1922	0.1937
7/32			32	0.2188	0.2210	0.2230	0.1986	0.1990	0.2005
1/4	20			0.2500	0.2532	0.2557	0.2175	0.2180	0.2200
1/4			24	0.2500	0.2528	0.2553	0.2229	0.2234	0.2254
1/4			27	0.2500	0.2525	0.2550	0.2259	0.2264	0.2284
1/4		28		0.2500	0.2524	0.2549	0.2268	0.2273	0.2288
1/4			32	0.2500	0.2522	0.2547	0.2297	0.2302	0.2317
5/16	18			0.3125	0.3160	0.3185	0.2764	0.2769	0.2789
5/16			20	0.3125	0.3157	0.3182	0.2800	0.2805	0.2825
5/16		24		0.3125	0.3153	0.3178	0.2854	0.2859	0.2874
5/16			27	0.3125	0.3150	0.3175	0.2884	0.2889	0.2904
5/16			32	0.3125	0.3147	0.3172	0.2922	0.2927	0.2942
3/8	16			0.3750	0.3789	0.3814	0.3344	0.3349	0.3369
3/8			20	0.3750	0.3782	0.3807	0.3425	0.3430	0.3450
3/8		24		0.3750	0.3778	0.3803	0.3479	0.3484	0.3499
3/8			27	0.3750	0.3775	0.3800	0.3509	0.3514	0.3529
7/16	14			0.4375	0.4419	0.4449	0.3911	0.3916	0.3941
7/16		20		0.4375	0.4407	0.4437	0.4050	0.4055	0.4075
7/16			24	0.4375	0.4403	0.4433	0.4104	0.4109	0.4129
7/16			27	0.4375	0.4400	0.4430	0.4134	0.4139	0.4159
1/2			12	0.5000	0.5050	0.5080	0.4459	0.4464	0.4489
1/2	13			0.5000	0.5047	0.5077	0.4500	0.4505	0.4530
1/2		20		0.5000	0.5032	0.5062	0.4675	0.4680	0.4700
1/2			24	0.5000	0.5028	0.5058	0.4729	0.4734	0.4754
1/2			27	0.5000	0.5025	0.5055	0.4759	0.4764	0.4784
9/16	12			0.5625	0.5675	0.5705	0.5084	0.5089	0.5114
9/16		18		0.5625	0.5660	0.5690	0.5264	0.5269	0.5289
9/16			27	0.5625	0.5650	0.5680	0.5384	0.5389	0.5409
5/8	11			0.6250	0.6304	0.6334	0.5660	0.5665	0.5690
5/8			12	0.6250	0.6300	0.6330	0.5709	0.5714	0.5739
5/8		18		0.6250	0.6285	0.6315	0.5889	0.5894	0.5914
5/8			27	0.6250	0.6275	0.6305	0.6009	0.6014	0.6034
11/16			11	0.6875	0.6929	0.6969	0.6285	0.6290	0.6320
11/16			16	0.6875	0.6914	0.6954	0.6469	0.6474	0.6499
3/4	10			0.7500	0.7559	0.7599	0.6850	0.6855	0.6885
3/4			12	0.7500	0.7550	0.7590	0.6959	0.6964	0.6994
3/4		16		0.7500	0.7539	0.7579	0.7094	0.7099	0.7124
3/4			27	0.7500	0.7525	0.7565	0.7259	0.7264	0.7289
7/8	9			0.8750	0.8820	0.8860	0.8028	0.8038	0.8068
7/8			12	0.8750	0.8805	0.8845	0.8209	0.8219	0.8249
7/8		14		0.8750	0.8799	0.8839	0.8286	0.8296	0.8321
7/8			27	0.8750	0.8780	0.8820	0.8509	0.8519	0.8544
1	8			1.0000	1.0078	1.0118	0.9188	0.9198	0.9228
1			12	1.0000	1.0055	1.0095	0.9459	0.9469	0.9499
1		14		1.0000	1.0049	1.0089	0.9536	0.9546	0.9571
1			27	1.0000	1.0030	1.0070	0.9759	0.9769	0.9794
1 1/8	7			1.1250	1.1337	1.1382	1.0322	1.0332	1.0367
1 1/8			12	1.1250	1.1305	1.1350	1.0709	1.0719	1.0749
1 1/4	7			1.2500	1.2587	1.2632	1.1572	1.1582	1.1617
1 1/4			12	1.2500	1.2555	1.2600	1.1939	1.1969	1.1999
1 3/8	6			1.3750	1.3850	1.3895	1.2667	1.2677	1.2712
1 3/8			12	1.3750	1.3805	1.3850	1.3209	1.3219	1.3249
1 1/2	6			1.5000	1.5100	1.5145	1.3917	1.3927	1.3962
1 1/2			12	1.5000	1.5055	1.5100	1.4459	1.4469	1.4499
1 5/8			5 1/2	1.6250	1.6344	1.6399	1.5069	1.5084	1.5124
1 3/4	5			1.7500	1.7602	1.7657	1.6201	1.6216	1.6256
1 7/8			5	1.8750	1.8852	1.8907	1.7451	1.7466	1.7506
2	4 1/2			2.0000	2.0111	2.0166	1.8557	1.8572	1.8612

All dimensions are given in inches

LEAD TOLERANCE. A maximum lead error of plus or minus 0.003 in. in one inch of thread is permitted

ANGLE TOLERANCE

Threads per Inch	Error in Half Angle	Error in Full Angle
4½ to 5½ incl	35 min plus or minus	53 min
6 to 9 incl	40 min plus or minus	60 min
10 to 28 incl	45 min plus or minus	68 min
30 to 64 incl	60 min plus or minus	90 min

Fractional Size Taps Commercial Ground Thread

Size	Threads per Inch			Major Diameter			Pitch Diameter		
	NC	NF	NS	Basic	Min	Max	Basic	Min	Max
1/4	20			0.2500	0.2540	0.2550	0.2175	0.2180	0.2190
1/4		28		0.2500	0.2525	0.2535	0.2268	0.2273	0.2283
5/16	18			0.3125	0.3170	0.3180	0.2764	0.2769	0.2779
5/16		24		0.3125	0.3155	0.3165	0.2854	0.2859	0.2869
3/8	16			0.3750	0.3800	0.3810	0.3344	0.3349	0.3359
3/8		24		0.3750	0.3780	0.3790	0.3479	0.3484	0.3494
7/16	14			0.4375	0.4435	0.4445	0.3911	0.3916	0.3926
7/16		20		0.4375	0.4415	0.4425	0.4050	0.4055	0.4065
1/2	13			0.5000	0.5065	0.5075	0.4500	0.4505	0.4515
1/2		20		0.5000	0.5040	0.5050	0.4675	0.4680	0.4690
9/16	12			0.5625	0.5690	0.5700	0.5084	0.5089	0.5099
9/16		18		0.5625	0.5670	0.5680	0.5264	0.5269	0.5279
5/8	11			0.6250	0.6320	0.6330	0.5660	0.5665	0.5676
5/8		18		0.6250	0.6295	0.6305	0.5889	0.5894	0.5904
11/16			11	0.6875	0.6945	0.6955	0.6285	0.6290	0.6301
11/16			16	0.6875	0.6925	0.6935	0.6469	0.6474	0.6484
3/4	10			0.7500	0.7575	0.7590	0.6850	0.6855	0.6886
3/4		16		0.7500	0.7550	0.7560	0.7094	0.7099	0.7109
7/8	9			0.8750	0.8850	0.8860	0.8028	0.8038	0.8050
7/8		14		0.8750	0.8810	0.8820	0.8286	0.8296	0.8306
1	8			1.0000	1.0095	1.0110	0.9188	0.9198	0.9212
1		14		1.0000	1.0060	1.0070	0.9536	0.9546	0.9556
1 1/8	7			1.1250	1.1350	1.1370	1.0322	1.0332	1.0347
1 1/8		12		1.1250	1.1315	1.1325	1.0709	1.0719	1.0729
1 1/4	7			1.2500	1.2600	1.2620	1.1572	1.1582	1.1597
1 1/4		12		1.2500	1.2565	1.2575	1.1959	1.1969	1.1979
1 3/8	6			1.3750	1.3870	1.3890	1.2667	1.2677	1.2695
1 3/8		12		1.3750	1.3815	1.3825	1.3209	1.3219	1.3229
1 1/2	6			1.5000	1.5120	1.5140	1.3917	1.3927	1.3945
1 1/2		12		1.5000	1.5065	1.5075	1.4459	1.4469	1.4479

LEAD TOLERANCE. A maximum lead error of plus or minus 0.0005 in. in one inch of thread is permitted

ANGLE TOLERANCE

Threads per Inch	Error in Half Angle
6 to 9 incl	25 min plus or minus
10 to 28 incl	30 min plus or minus

Fractional Size Taps Precision Ground Thread

Size	Threads per Inch		Major Diameter		Basic Pitch Diameter	Pitch Diameter Limits			
						01 Limit	1 Limit	2 Limit	
	NC	NF	Min	Max		Min 01	Max 01 Min 1	Max 1 Min 2	Max 2
1/4	20		0.2540	0.2550	0.2175	0.2170	0.2175	0.2180	0.2185
1/4		28	0.2525	0.2535	0.2268		0.2268	0.2273	0.2278
5/16	18		0.3170	0.3180	0.2764	0.2759	0.2764	0.2769	0.2774
5/16		24	0.3155	0.3165	0.2854		0.2854	0.2859	0.2864
3/8	16		0.3800	0.3810	0.3344	0.3339	0.3344	0.3349	0.3354
3/8		24	0.3780	0.3790	0.3479		0.3479	0.3484	0.3489
7/16	14		0.4435	0.4445	0.3911	0.3906	0.3911	0.3916	0.3921
7/16		20	0.4415	0.4425	0.4050		0.4050	0.4055	0.4060
1/2	13		0.5065	0.5075	0.4500	0.4495	0.4500	0.4505	0.4510
1/2		20	0.5040	0.5050	0.4675		0.4675	0.4680	0.4685
9/16	12		0.5690	0.5700	0.5084		0.5084	0.5089	0.5094
9/16		18	0.5670	0.5680	0.5264		0.5264	0.5269	0.5274
5/8	11		0.6320	0.6330	0.5660		0.5660	0.5665	0.5670
5/8		18	0.6295	0.6305	0.5889		0.5889	0.5894	0.5899
3/4	10		0.7575	0.7590	0.6850		0.6850	0.6855	0.6860
3/4		16	0.7550	0.7560	0.7094		0.7094	0.7099	0.7104
7/8	9		0.8835	0.8850	0.8028		0.8028	0.8033	0.8038
7/8		14	0.8810	0.8820	0.8286		0.8286	0.8291	0.8296
1	8		1.0095	1.0110	0.9188		0.9188	0.9193	0.9198
1		14	1.0060	1.0070	0.9536		0.9536	0.9541	0.9546

LEAD TOLERANCE. A maximum lead error of plus or minus 0.0005 in. in one inch of thread is permitted

ANGLE TOLERANCE

Threads per Inch	Error in Half Angle
8 to 9 incl	25 min plus or minus
10 to 28 incl	30 min plus or minus

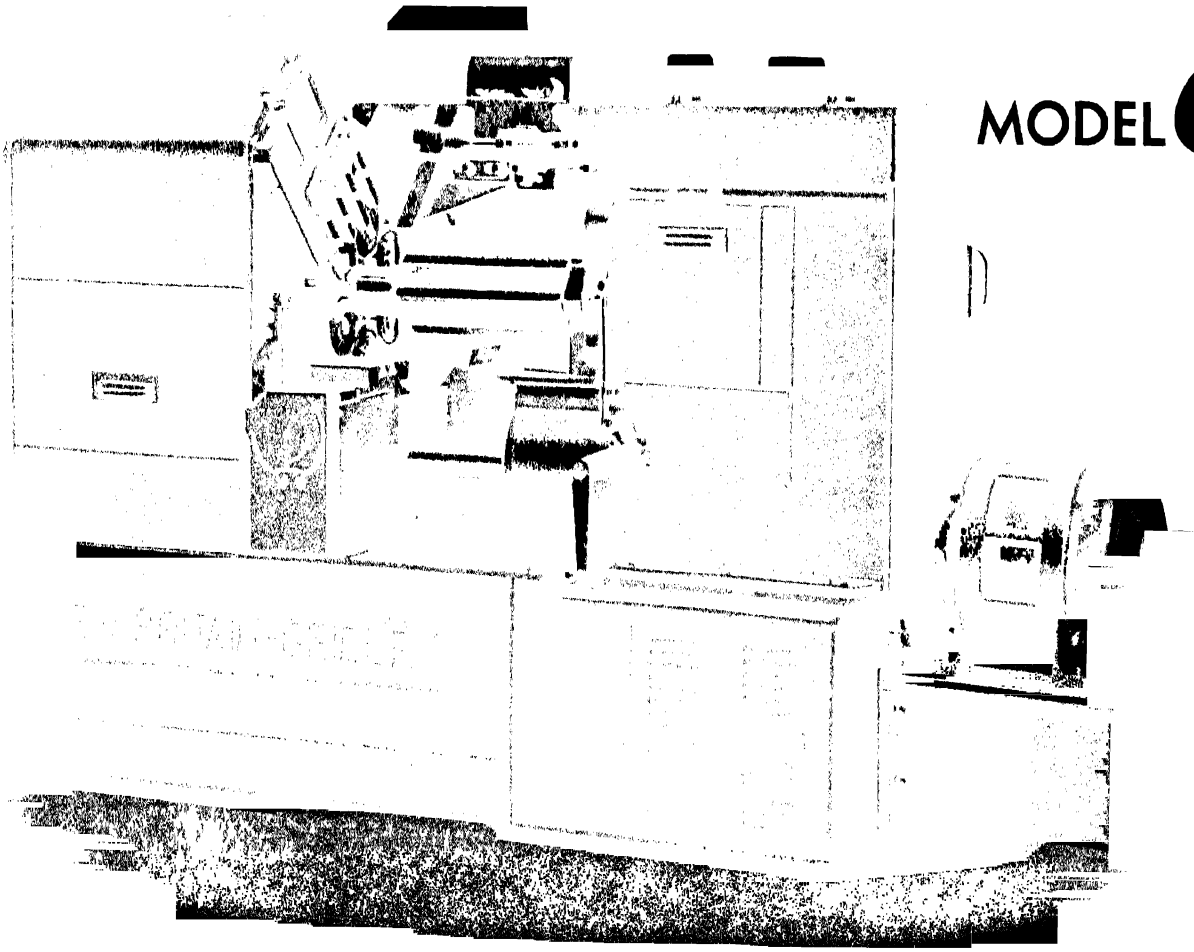
FOR THE DEFENSE PROGRAM

A complete line of 6 Spindle Automatic Screw Machines for the production of:

FUSE BODIES AND COMPONENTS
BULLET CORES
SMALL PROJECTILES
AND
OTHER RELATED PARTS

NEW BRITAIN-GRIDLEY

MACHINE DIVISION • THE NEW BRITAIN MACHINE CO.
NEW BRITAIN, CONNECTICUT



MODEL 6

. complete line of Screw Machines — Four and Six Spindles to 2 ¼" Capacity
to a complete line of Chuckers — Four, Six and Eight Spindles to 1 ⅝" Capacity

Set the Public Straight

A DELIBERATE campaign against industry in connection with the defense program is going on. It is hard to prove that it is a concerted drive to poison the public's mind against industry. Yet the effect will be that unless something is done to offset it.

The excuse for the campaign is the refusal of most manufacturers to sign armament contracts unless they can write off new plant investments in five years or less. Such refusals, it is charged, have seriously delayed production of planes, tanks and other vital materials.

An example of the attacks on industry is the Department of Justice's action in asking the Supreme Court to take up a case in which the government seeks modification of wartime contracts made with Bethlehem Shipbuilding in 1917 and 1918. The department links this action to the present situation by declaring that "in times of national emergency the men charged with preparing the nation's defenses have no time to haggle with a contractor who refuses to perform his indispensable functions unless he be assured an exorbitant profit."

This sort of tactics by the Justice Department seems unwarranted. It is like dragging a skeleton out of the closet. You might as well go back and assail some of the practices of Standard Oil before the dissolution decree of 1911. The cost-plus type of contract which Bethlehem Shipbuilding had in 1917 isn't even being considered today. An excess profits tax soon to be enacted by Congress, not to mention limitation of profits, will effectively prevent exorbitant profit-making. What industry wants is assurance that it will get back the money it puts into defense ventures, clear aside from any possible profits. Yet publicity released by the Justice Department regarding this ancient case implies that the government must be saved from being the prey of industry.

What can be done to convince the public that industry is seeking merely fair and equitable treatment? What can be done to make it clear to the public that it won't be industry's fault if huge quantities of planes and of munitions aren't being turned out in the next few months?

At least two ways appear open. One is for industrialists to agree to proceed with necessary plant construction and tooling without waiting for the exact terms to be worked out. Some plane makers have chosen that course, which puts the responsibility for a square deal on Washington. But surely industry can be pardoned if it shivers and shows signs of running a temperature when it contemplates what Washington may consider a fair deal. Will it be Jesse Jones' definition or Harry Hopkins'?

The other course of action is for every manufacturer involved in defense plans to make frank reports to all employees and to his community on his contractual relations with the government. He should not hesitate to report the terms, why he has rejected any objectionable contract, what the contract means to his employees and to the community in increased payrolls and more employment while the defense effort is being furthered.

No piece of public relations is half so vital to industry at this time as telling the people frankly and fully its part in arming the nation and in explaining how much or how little it stands to profit financially. A big educational job confronts industry.

Burnham Finney

GAGING BUSINESS

Release of aircraft orders means new plant expansion. Pratt & Whitney's award for 17,000 engines tops list. Buying of railroad equipment improves. Large munitions orders to break

Business is definitely entering the boom period of defense boom in the sense of employment and expansion of plant and output, rather than profits For between profits limitation excess profits taxes and compulsory contracts most business men are resigned to modest earnings Even so they resent the inference that they are not as patriotic as the citizens who say it with words but not with dollars and they see no excuse for the plant seizure clause in the Senate draft bill

Machine Tools Domestic demand now far overshadows the foreign buying that loomed so large earlier in the year Defense needs direct and indirect form the biggest single factor with more heavy buying in the offing as new armament plans get under way Despite a high level of activity August orders proved spotty some sections of the country report sales at a peak, while others found the month far below the year's average Deliveries are still a problem but buyers are getting used to them and are learning to anticipate their needs Inquiries are extremely active pointing to the prospect of continued good demand throughout the balance of 1940 Chrysler, Packard Ford and General Motors are all planning new facilities for aircraft and armament manufacture Within a month some large orders should be placed for this purpose Canadian business is good

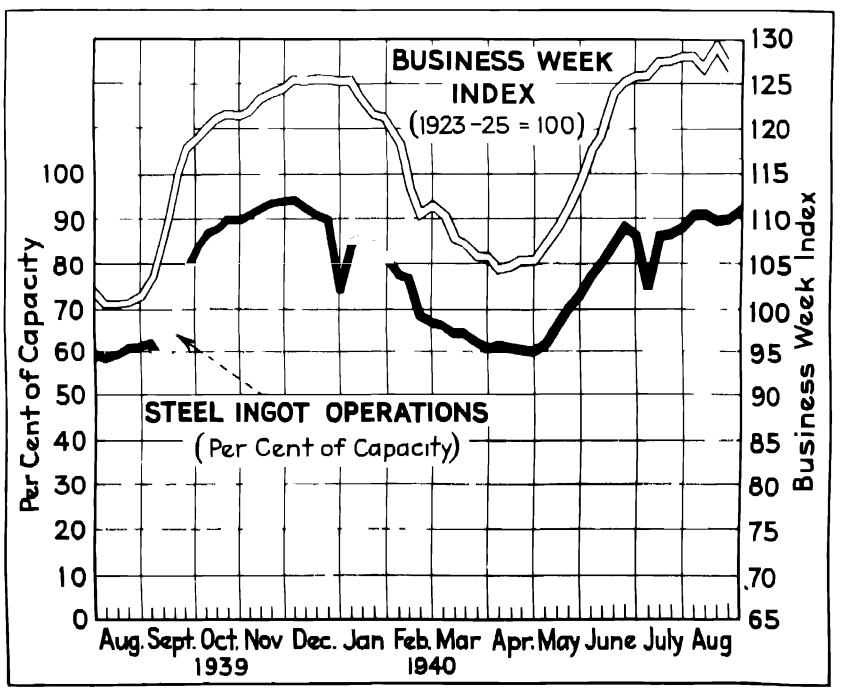
Railroad Equipment With the Chicago Rock Island Pacific announcement of 800 cars ordered from Pressed Steel Car Co, freight car purchases for the first eight months of the year now exceed 20,000 cars, well ahead of last year at this time Fifty nine passenger cars ordered in August exceed the 51 placed in the first seven months of the year Sixty-one locomotives ordered in August brings the year's total near the 300 mark Other activity includes modernization of 1,000 cars in its own shops by Chicago and Northwestern Railroad and rebuilding of 400 cars by Chicago, Rock Island & Pacific

Steel The steel situation appears to be safe against shortage for at least the next two months civil operations are slackening and heavy users have accumulated comfortable stocks against forthcoming heavy demands The Navy has taken bids on 180,000 tons for strictly maintenance uses Materials supervision will safeguard against overstocking by both defense contractors and civil users

Aircraft—Such is the magnitude of recent aircraft orders that political bickering as to whether or not the air program has bogged down can now be shelved Pratt & Whitney has received one of the largest orders on record $160 000 000 for 17 000 radial engines Plant expansion to handle this volume is to be financed by the company while machine tool equipment will be bought and title held by the government a unique method of cooperation The Army has placed a $14 861 342 order for Consolidated bombers while North American Aviation is to supply planes to the value of $11,335 631 Orders for army training planes have been received by Beech Aircraft ($3 110 716) Stearman Aircraft ($2 041 947), and Fairchild ($1,038,300) A $1,090,894 engine order has been placed with Continental Motors New announcements of additional expansions are popping every day

Munitions Less than a third of appropriations to date ($6,600,000 000) have been placed under contract and much of this is Navy work extending to 1942 3 4 Once the amortization and tax bills pass contracts for large amounts will be awarded within 60 days Heavy defense buying is certain to involve new plant construction as well as purchase of materials and equipment Since Army needs are for short term production the Army will get the lion's share of appropriations now pending Of the first big defense outlay, the Navy got, in round figures, four billion, the Army one billion the pending bill almost exactly reverses these figures Army plans for 1,800 tanks may be supplemented by British orders for 4 000, approval of the latter order is being sought in Washington Orders for gun equipment have been placed with Miehle Printing Press ($1,100,000), Baldwin Locomotive Works ($3 131 000) Westinghouse ($10 865 200), and Blaw Knox ($1,2 12 000)

Farm Equipment The Army has been testing a high speed adaptation of the farm tractor which is being manufactured by Minneapolis Moline Power Implement Co Weighing seven tons the tractor features a low center gravity 40 miles per hour speed and 7,500 lb drawbar pull



Contrary Reports On Airplane Defense Program Continues Despite Recent Orders

WASHINGTON—Despite the many orders recently placed, charges continue that the defense airplane contract program has bogged down. President Roosevelt, manfully defending his Defense Commission, gave a good statistical answer to the critics at his last press conference However, there seems to be further reasons for the delay of which the President probably would not feel free to mention

One is that, regardless of contracts signed, the industry is building planes as fast as it can Yes, critics say, but the industry could start its plant expansion if it had the green light Major units (Martin Boeing, Douglas, Curtiss-Wright, Pratt & Whitney, Packard) are already pushing expansion to the limit of their available manpower Probably much more preparation than is indicated is being carried on by other companies, in anticipation of amortization guarantees by the Government

The other answer for the delay is that if this country wants to help Great Britain, as the majority undoubtedly do nearly all of the military planes we can build will have to be sold to Britain as long as she fights

Mr Roosevelt's answer to this was that since September the nation's capacity to produce military and training planes has increased from 6,000 to 10,000 By Jan 1 it will be 13,000, he said During 1941 it will reach 24,000 and in 1942 we can turn out 35,000 He said that actual contracts at this time for War and Navy, call for 6,361 In addition under "letters of intent", manufacturers are going ahead on 3 054 planes for the Army and 600 for the Navy with the total being 10,015

A maze of contradictory figures some ridiculously small are being quoted by critics of the Administration in Congress However, the criticism has revealed that most of the planes we do have on order are trainers, and that the major portion of the airplane program is still sidetracked in the five-billion dollar supplemental defense bill over which the Senate is haggling

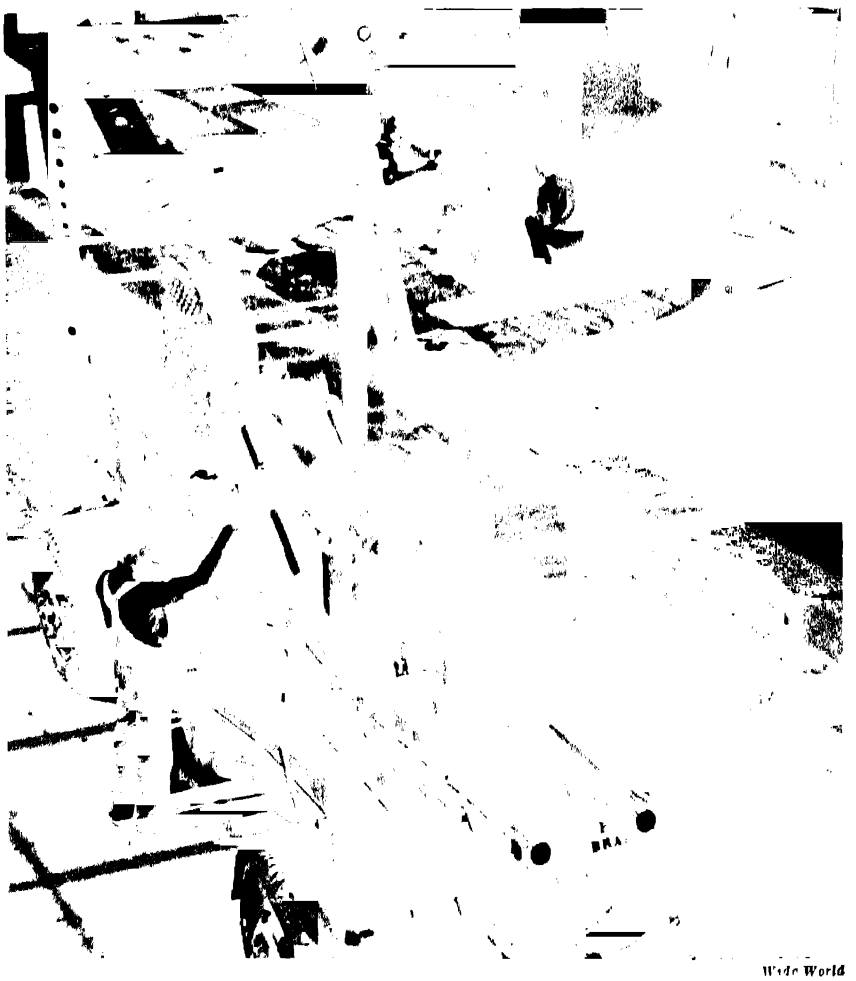
17,000 ENGINES SPEEDED

WASHINGTON In order to save the time of manufacturers the Defense Commission has agreed with the War and Navy departments that each department should deal alone with certain companies In this way the manufacturer's output is restricted to one customer instead of two or more For that reason Pratt & Whitney's order of 17 - 000 engines to be delivered to the Bureau of Aeronautics and the Air Corps was placed by the Navy Tooling-up will take about eight month for this job but the government is depending on the cooperation of machine tool makers in the way of priorities Tools will cost $1,000,000 plant expansion $2 500,000 The total amount of the Navy order is $160,000,000 which makes the unit cost, $9,411 76 Engines delivered to the Army will be paid for by a transfer of funds to the Navy for that purpose

RFC Loans Totaling $78,500,000 Go To 3 Airplane Manufacturers

WASHINGTON—Loans totaling $78 - 500,000 were authorized by RFC to three airplane manufacturers The largest went to Curtiss Wright for expansion of several plants and one new plant near Lackland, Ohio, total $51,000,000 Bendix Aviation was awarded a loan of $17,000,000 for enlargement of plants and for purchase of equipment A commitment of $10,500,000 was made to Boeing Aircraft Company for extension of its plant at Seattle and for expansion at Wichita, Kansas, where the Stearman trainer is built Previously, Curtiss Wright had been granted an RFC loan of $92,000,000 for expansion of many of its lines

Meanwhile Pratt & Whitney, Vought Sikorsky, and Hamilton Standard Propeller divisions of United Aircraft were committed to spend a total of $15,000,000, privately financed This is the third United Aircraft expansion within the year and it will increase the engine output by about 1500 per month While Wright Aeronautical sticks pretty much to engines in the 1000 hp. class, Pratt & Whitney continue to make smaller engines for training planes.



Wide World

Hellzapoppin—*Or soon will be when these 3-inch anti-aircraft guns are placed into operation by the U S Army. At York, Pa., the York Safe & Lock Co produces guns and gun carriages as an integral part of the defense program In the foreground are outrigger supports for guns*

Chrysler Tank Plant May Cast Armor Instead of Fabricating From Rolled Plate

DETROIT— As yet contracts have not been let by the Chrysler Corp. for the government tank plant which it is building on a 113-acre tract just outside of the city. Plans for factory buildings are being drawn, but weeks of planning remain before all details of machinery and tooling can be decided. And there are rumors that the Army has a new idea for tank fabrication that may hold up some major phases of the program until it is threshed out. Briefly, a suggestion has been made that the armor section might be cast instead of fabricated from rolled plate.

The armor section is huge—measuring perhaps 9 ft. wide by 20 ft. long by 4 ft. deep and being from one to three inches thick at various sections. Casting such a structure would probably require pouring 30,000 lb. of metal. Besides, other machining and heat-treating methods would be required as compared to the fabricated design

Just because tank armor has not been cast before is no reason to reject the idea. The war in Europe has changed concepts of tanks rapidly. At first, one-half inch armor was considered sufficient for the Chrysler program. But later on expert advice from the British started thicknesses moving upward, until two and three inches are being considered for vital sections of 25-35 ton cannon-carrying tanks.

The casting idea may be thrown out before this article is published. But the point is this: design details can and probably will be changed a number of times before the plant is ready to operate. If it actually gets going before the scheduled thirteen months allowed for construction—sometime next summer—a monumental job will have been accomplished.

Unofficial estimates place the number of tanks involved in the contract at approximately 1,000, at a cost of $34,500,000. The rate of production in the finished factory is scheduled to be four or five units per day. The factory which may be completed within 13 months will employ between 4,000 and 5,000 workers.

When the plant which will cost $20,000,000— paid for by the government—is completed the company will return it, will then lease it for $1 a year for the life of the contract. In addition the plant will be designed for immediate expansion if found necessary.

Signature of the contract was the result of two months of engineering studies and negotiations between the company and the defense commission. Besides Chrysler, the American Car & Foundry Co. is engaged in tank building, White Motor Co. is building combat cars, and Baldwin Locomotive is building heavy tanks for national defense.

Pratt & Whitney Engine May Be Produced by Ford Co. Soon

DETROIT—Details of the Ford program to build Pratt & Whitney engines were still being worked out in Washington last week. Final writing of a contract may take several months, but Ford is going ahead with plans to build a plant in the Rouge and to ascertain equipment needs. Pratt & Whitney practice will be duplicated, so the time consumed in developing an original proposition will not be required.

Ford's liquid-cooled engine has reached the point where it may be possible to start the tooling-up process within six weeks, and actually begin manufacture in a year. For the liquid-cooled job it is possible that some of the 10,000,000 sq. ft. of floorspace in the Highland Park plant will be utilized. So far nothing has been moved into that plant in recent months except upholstery and trim operations. But perhaps the Highland Park plant will not be used for airplane motors at any time. Company officials stated positively that a plant would be erected at Rouge for the Pratt & Whitney undertaking, and that no "government" plant was contemplated.

Export of Plane Products Increase 182 Percent In 6 Months

WASHINGTON—For the first six months of this year exports of aeronautics products increased over the same period in 1939 by 182 percent to a total of $138,388,046. Exports for the last half of 1939 were increased by over 100 percent, and by 17 percent over the value of shipments for the entire last year.

France and England took 68 percent of the total exports in the first six months of 1940. French purchases for that period amounted to $75,375,565, while England purchased $8,167,976.

A total of 1,532 aircraft, valued at $95,261,402, was among the aeronautic products exported in the first half of 1940. This virtually doubled the shipments in the last half of 1939. Exports of aircraft engines in the first six months of 1940 amounted to 2,008, valued at $17,704,362, while shipments of engine parts and accessories were valued at $7,240,362.

ASKS LAW AGAINST SABOTAGE

WASHINGTON — Secretary of War Stimson has asked Congress to authorize the President to invoke the war-time law against sabotage. Mr. Stimson notes that there is insufficient legislation to prevent subversive activity against munitions plants and utilities. The proposed Act by Congress would provide ten years imprisonment and $10,000 fine for violation.

SENATE VOTES RIGHT TO SEIZE PRIVATE PLANTS FOR DEFENSE

WASHINGTON—The Senate adopted an amendment to the conscription bill which will permit the government to commandeer private plants which refuse to co-operate in the national defense program. Under this proposal any private plant necessary for defense preparations which cannot reach an agreement for its use or operation by the War or Navy departments would be subject to condemnation proceedings. In addition, the government, after filing such proceedings may take possession of the plant and operate it either with its own workers or by contract with private firms. The amendment was accepted by a Senate vote of 69 to 16.

However, this needs some explaining for statutes, already existing, authorize the President to commandeer production facilities in an emergency. In this case the President would have to invoke the "war imminent" clause of the National Defense Act. Observers indicate, however, that the time is not ripe for such a move. Further in the Navy speed-up act of last June, the Secretary of the Navy is authorized to take over and operate such plants as do not cooperate and which he deems necessary to the national defense. He may also fix the compensation for such plants.

The passage of the present law repeals the right of the Secretary of Navy to fix compensation for plants, gives the Secretaries of Navy and War the right to enter into possession. However, the second war deficiency bill ($5,000,000,000) passed by the House and Senate, and sent back to the House for any changes, repeals the confiscation power granted to the Navy in June. At the last moment the Senate adopted an amendment applying the 7-8 per cent Vinson-Trammel profit limitations to the purchase of ordnance from industry. At the present time plant confiscation and the ordnance profit limit still depend on action of Congress in two bills still to be considered. However, the vote indicates peace-time commandeering may be granted.

Aircraft Industry, Soon To Employ A Million Men, Is Fertile Field For Labor Unions

NEW YORK—The aircraft and aircraft parts industry which before long are expected to employ an estimated million men are a tempting pasture for labor unions They are in fact so lush a field for union expansion that both CIO and AFL consider aircraft their number one organizing job Two CIO units have jurisdictional claims in the industry The United Automobile Workers with an aircraft division and The United Radio Electrical and Machine Workers whose charter gives them CIO sovereignty over the metal working shops The AFL claimant is the International Association of Machinists

The unions are seeking to organize around certain standard grievances which the aircraft industry as a comparatively new industry provides in a rather pronounced degree Thus for example the talking point of the auto workers union is the alleged wage differential which exists between auto and aircraft workers The union promises to wipe out the differential which it claims runs as high as 35 for comparable skills in the two trades Seniority and job security are also union demands

The machinist unions appeal is directed largely at the craftsmen Wage increases preservation of craft prerogatives and a voice in the settlement of grievances is the refrain of their marching song

So far the CIO and AFL have not come into direct competition The labor committee of the National Defense Advisory Commission is expected to keep the decks clear of fratricidal strife What has kept them out of each others way is a rough geographical division of their energies With approximately 60 of the industry located in the Far West the AFL has busied itself in the North and the CIO has tackled the Southern California centers The AFL has the big Boeing plant in Seattle and the CIO has just won a Labor Board election at Vultee in Downey and is petitioning for a poll at Ryan in San Diego From these spots both organizations are expanding outward

Aware of the sensitivity of public opinion on matters touching national defense union leaders will call for strike action only as a last resort The organization program calls for peaceful penetration through day by-day organizing and supplemented by Labor Board action The relative peaceableness of the strategy however lies its determination The unions are prepared to use all their resources in order to organize the aircraft industry

DEFENSE BUYING ONLY HALF STARTED

WASHINGTON Industry has yet to feel the real impact of defense buying Although $6 600 000 000 has been appropriated only about $1 800 000 000 has been placed under contract The major part of the contracts covers Navy requirements with some extending into 1942 43 and 44 Most of the work covered by the awards made to date is slow getting under way On many of the larger contracts a good deal of engineering remains to be done before production can start Once the excess profits tax and amortization bill is passed there will be probably two or two and a half times as much in contracts placed in the 60 days following as placed in the time since the appropriations were made The new buying which is expected will require materials and labor immediately New plant construction and equipment will call for specially urgent handling

Congress May Revolt Against Plane Shipments To Britain

WASHINGTON—While the citizenry goes on believing that the aircraft industry is grinding out airplanes faster and faster for the Army and Navy the Administration continues with its apparent determination to deliver nearly the entire output except training planes, to Great Britain But an element in Congress may revolt against this—with what possible success no one can say Whether this contingency is part of the situation or not, Britain is seriously discussing with the Defense Commission and the Administration the possibility of a system of British airplane plants in this country to produce 1 300 planes per month for shipment abroad



The Largest And Most Powerful Airplane *In the United States Army's giant bomber the Douglas B 19 With a wing spread of more than 210 feet the flying arsenal will weigh over 140 000 pounds have four air cooled 2000 H P engines as the one pictured above*

U.S.-Canada Defense Move May Result In Specialized Canadian War Production

MONTREAL The recent U S -Canada defense understanding culminating last week in the first meeting of the U S -Canada Defense Board, is expected to have far-reaching implications on the machine tool and metal-working industry, on the entire Canadian war production program Although only limited agreements, plans, and arrangements are likely to be announced in the period immediately ahead many observers believe that close cooperation between the U S and Canada on economic and financial matters is a logical development

The U S -Canada agreement comes at a time when Canada's war industry development program was threatened with partial collapse The limited facilities for making machine tools have been strained to capacity Although additions are being made to existing plants the industry itself is seriously short of skilled craftsmen Specifically, Canada needs $65,000,000 of machine tools to equip the $170,000,000 new war plants which will be completed within the next six months In aviation Canada has no facilities for making airplane engines is forced to depend on England's supply which since the capitulation of France, has been negligible

May Coordinate Production

An expected development from the U S -Canada defense move is an agreement which will see specialized production of war materials in each country In this way items which can be made faster and at a lower cost in the U S will be manufactured there Later they will be traded to Canada for articles which can be made faster and more cheaply in that country

For example, Canada is expected to abandon plans for the erection of airplane engine factories, and it is confidently believed that arrangements will be made for the U S to supply all engines needed Because of the abundant supplies of low cost power and raw materials such as cellulose, most of Canada's $170,000,000 new war plants are to manufacture explosives and war chemicals Because coal and iron ore must be imported from the U S , Canada's steel production facilities are small Rather than expand, Canada will probably look to the U S for steel products, especially armor plate and battleships.

Other probable developments include the revision or elimination of tariff barriers in order to make procurement by both countries less costly Financially the U S may assist by utilizing the new lending power of the Export-Import bank to take over responsibility for Canada's huge surplus of grain U S money markets may be reopened to Canada its credit position stabilized

Plants Are Active

Meanwhile production continues at a fast pace A $600,000 contract has been awarded to Aero-Marine Crafts Ltd , Toronto, for six large rescue boats In Alberta an $8,000,000 government financed ammonium nitrate plant is under construction It will be operated by Consolidated Mining Smelting Co of Canada in conjunction with Canadian Industries Ltd

Within seven months the Bren gun plant in Toronto will be producing five times as much as originally planned The Canadian General Electric plant Peterborough Ont has received large orders for precision equipment and artillery The new gun plant at Sorel Que will be producing 25-pounder guns in a month Some $10,000,000 is being expended to equip the plant with lathes for naval guns

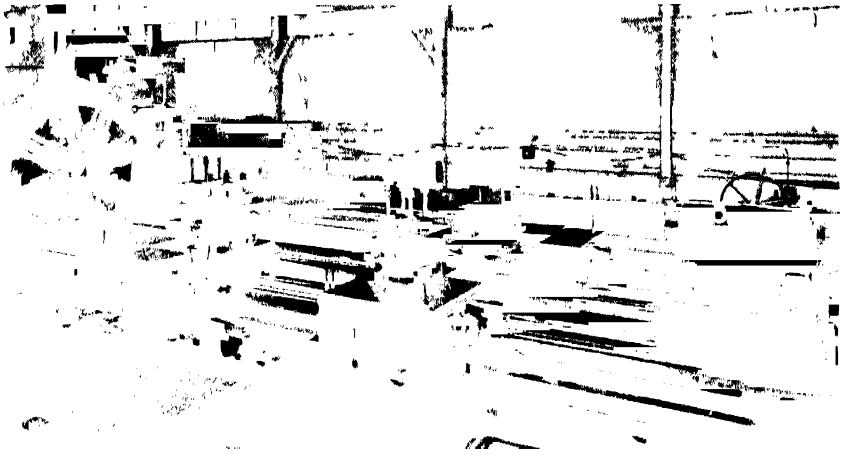
Some recent government defense orders are as follows Machinery Harrison Co Montreal, $32,122, Consolidated Mining & Smelting Co , Ltd , Montreal $334,500, Harrington and Richardson Worcester, Mass $13,188, Peerless Handcuff Co Ltd Springfield Mass , $13,480, Munitions Anaconda American Brass Ltd New Toronto, Ont $35 275, Remington Arms Co , Inc Bridgeport, Conn $74,268, Ordnance Colt's Patent Fire Arms Mfg Co , Hartford, Conn $257,663, Aircraft supplies, Parmenter & Bulloch Co , Ltd , Gananoque, Ont , $17,800, and DeHavilland Aircraft of Canada Ltd , $10,368

HEAVY ENGLISH BUYING IN SIGHT

WASHINGTON — Coordinated with our own defense is a plan being considered by the Defense Commission under which our government will approve placing of orders for 4 000 tanks for the British Thus far our own plans call for 1,800 Preliminary to agreements to permit the British to place orders here, they have to accept American plans and standards In case the orders fall through plant capacity set up to meet them could be taken over without any hitch Meanwhile great pressure is being put on plans for production on a large scale for both the British and our own planes of 20-mm cannon (1 6 in) They have an effective range of 1,700 yards, would completely change aerial combat There is other heavy British buying coming up for co-ordination

Allison Seen To Be Expecting Additional Army Orders Soon

WASHINGTON – Word goes among machine tool and aircraft engine men visiting here that Allison has been buying more plant equipment than it needs for the present production schedule Some observers take this to mean that the company is about to solve its alleged trouble with maximum horsepower output and is expecting large additional orders from the Army This conclusion is almost clinched by the fact that the Curtiss-Wright P40 and P40D the terrific new Lockheed interceptor (500 mph top reported by the Air Corps) and the Bell ships, are being built at an increasing rate, presumably around the Allison engine



Veteran Of World War I—*Although this gun lathe is one of twenty which has been idle since 1918 The Simmons Machine Tool Co is rebuilding them as a part of the defense program Each lathe weighs 000 000 pounds and, when dismantled, fills ten railroad cars*

WATCHING WASHINGTON

Defense Commission confused by lack of national unity. House passes bill authorizing President to requisition machine tools and other defense materials held here by foreign purchasers

By BLAINE STUBBLEFIELD

WASHINGTON—The Defense Commission is now at the bottom of a valley of confusion from whence it may reasonably expect to begin an early ascent to more light. The chaos is not as bad as it looks to the citizen observer, but it is bad enough. If the commissioners are surprised to find themselves so involved it is because some of them are not experienced in politics. However, the political set-up that created the Commission, plus the coincidence of the election, could hardly have produced any other result.

The basic trouble seems to be the lack of national unity on the issue of defense. This results from the fact that the U.S is not in a war, which would pull all forces together. However, the country is by no means agreed on whether it wants a war, or whether it is even threatened with one. In a word the war party and the peace party each are trying to outdo the other, and the Defense Commission is in the middle.

The Commission and Congress are each blaming the other for failure to make adequate progress. Their exchanges are too long and complicated to detail here. But if you write it all in one equation and cancel out, the principal blame appears to land on the politicians, mainly in Congress. The defense manufacturers, while they are not free from selfish motives, and the Commissioners, who have almost no axes to grind, would be making commendable progress by now if the politicos would let them.

The present situation sees the Vinson-Trammel law still in force. It limits profits on aircraft and naval vessels to 8%. But the Administration has agreed that a section of the pending excess profits law shall repeal the profit limitation. Meanwhile, the Commission has succeeded in *clearing* some $4,000,000,000 in munitions orders with manufacturers like Douglas, Chrysler and others, who are willing or able to take a chance on amortization of plant expansion cost. Such companies expand on their own money, or on money borrowed from RFC. This is done under a "letter of intent" of the Government to order a given number of planes, tanks, etc., as an inducement to go ahead with tooling up. The reason the manufacturers are afraid to expand and tool up without an amortization guarantee of some kind, is that a Hitler peace or world disarmament are still possibilities. Under these conditions, manufacturers stand to lose a great personal investment—new plants ready to produce a product for which there would be no demand would be listed as a debit not a credit.

To add facility to the financing of defense production, the Commission now proposes an innovation which it calls a "Bankable Contract". This will permit contractors to finance expanded plant and equipment by borrowing, or guaranteeing their own investments, with the contract as collateral. The Government would reimburse the contractor, not in additions to unit prices of the product, but in five equal annual installments covering the amount of his capital expansion cost. Then, cost of supplies and amortization of construction would be separated. This proposal must be approved by Congress. It is spectacular, but its importance should not be over-estimated. Lack of capital has not and is not holding up the defense program.

As for the future, the program waits upon two major acts by Congress: the excess profits tax, which will lay down a definite plan of expansion cost amortization, and the approval of the second supplementary defense appropriation of $5,000,000,000 by the Senate. The last stumbling-block to be removed will be the November election. Suppose it's Roosevelt. His ire at the dictators is much stronger than his dislike of business, and that should save the Commission's head, which might otherwise be lopped off to make room for a New Deal war council. FDR knows the Knudsons and Stettiniuses are better men than the Corcorans and Hopkinses. If it's Willkie, and if he's as strong as he said for defense, he will appoint a chairman to coordinate the Commission, which now has none.

4,361 JULY EXPORT LICENSES GRANTED

WASHINGTON—During July, 5 to 31 inclusive, the State Department's Division of Export Control received 6,242 applications for license to export goods on the President's prohibited list. Of this total, 5,397 were disposed of; 4,361 were granted; 236 were rejected on the ground the articles were essential to defense; 104 were returned with the request that further data be submitted; 696 were returned with the statement that no license was required for the contemplated exportation.

House Passes Requisition Bill

The bill authorizing the President to requisition machine tools and other defense materials and equipment which have been ordered by foreign purchasers, but which have been refused export licenses, was passed by the House without a record vote. Although the bill has gone to the Senate, the Military Affairs Committee of the upper House is holding it up, waiting for reports from the Army, Navy, and other government agencies. The Senate group is said to feel that the House gave the measure too little study. Administration leaders of course are irked by this delay, which they feel is unnecessary and detrimental to the progress of defense production. The bill authorizes the President to pay a fair price for the goods requisitioned. If the owner is unwilling to accept the President's offer, he will be paid 50% of the sum offered and may sue for his price in the courts. Officials assured AMERICAN MACHINIST that the materials to be requisitioned are seriously needed by defense industries, but they would not comment on the question whether the bill is aimed at Japan, which is a heavy buyer of U. S. machine tools and other equipment.

Great Lakes May Boom

Great Lakes shipbuilding yards probably would come in for a considerable share of torpedo boat building, if the Navy goes into a big proposed mosquito fleet program. A letter from Secretary Knox to Senator Wiley of Wisconsin indicates that the Navy has some 30 types of small fighting boats under experimental orders and that they will be assembled at one point and given thorough tests. Thirteen Great Lakes firms built 25% of cargo shipping in the period of World War I. The small boats now planned could be brought out on rail cars or taken down the St. Lawrence. This is in addition to a big submarine building program.

Manufacturers, Not Dealers, Should Apply For Licenses To Export Machine Tools

WASHINGTON—The Administrator of Export Control has directed that, beginning September 1, 1940, applications for license to export machine tools be submitted by the manufacturer, rather than by a dealer, forwarding agent or other individual. This modification in the procedure has been found necessary in order to avoid duplication, and to ascertain from the best source, the manufacturer, whether from the standpoint of his productive capacity approval of the application will be contrary to the interests of National Defense.

The applications must be accompanied by information as follows:

Name of machine.

Type, model and size (catalogue designation).

Electrical equipment.—

(1) If D.C. Voltage, two or three wires.

(2) If A.C. Voltage, phase, cycle.

Metric or English dials, screws or gearing.

Variation from catalogue listing of machine.

Whether machine is complete and ready for shipment; or, if in production, percentage of completion and expected date of completion.

Special tooling or fixtures and selling prices thereof.

Product to be manufactured by the machine.

An indication of the effect of the order on production, such as the statement:

"We have no orders in hand for machines of this type, required for the United States Defense Program, for which requested delivery dates will not be met."

Applications for license to export which are submitted by dealers, export agents, or the purchasers, on and after September 1, will be returned for resubmittal by the machine tool manufacturer.

SENATE PASSES $5,128,169,277 BILL

WASHINGTON—The Senate passed the "Total Defense" appropriation bill of $5,128,169,277 and has sent it back to the House for concurrence and amendments, if any. This is the much talked-about "five billion dollar bill." The bill provides for (1) continued expansion of the Navy; (2) more complete equipment for a land force of about 1,200,000 men; (3) a reserve stock of tanks, guns, artillery, ammunition for another 800,000 men, or a total of 2,000,000 if full mobilization is ordered; (4) plant expansion, public and private facilities necessary for the production of critical items such as guns, bombs, armor, and ammunition; (5) procurement of 4,028 additional planes with spare engines for Army and Navy.

SENATE LOOKS AT 20 TO 50% EXCESS PROFITS TAX BILL PASSED BY HOUSE

WASHINGTON—Last week the House passed the defense excess profits tax bill. Although the Senate's Finance committee sat in at hearings with the House Ways and Means committee with the intention of later dispensing with Senate hearings, it seems now that the Senate will hold hearings notwithstanding. What changes the Senate will make or how long it will take is unpredictable.

As it stands now the tax bill: (1) Would levy an excess profits tax on abnormal industry profits due to the government expenditure of $14,000,000,000 for defense. The tax would range from 20 to 50 percent. (2) Permit industries who are expanding their plants to charge 20 percent of the cost against their taxes each year for a period of five years. (3) Suspend the Vinson-Trammel profit limitation which is 8 percent of contract price or 8.7 percent of performance cost for the duration of the defense program.

The profit limitation may be placed on ordnance orders if the conscription bill carrying an amendment to that effect is passed. Then if the Senate passes the tax law as passed by the House, the profit limitation on Navy, Airplane and Ordnance construction will be suspended.

The legislation was drawn so that small or new corporations and those lately unprofitable will not suffer. The totals to be raised by the bill are to be greater than would have come from the first draft. Tax experts of industry have provided many usable suggestions.

U. S. Government Contracts Awarded to Metal-Working Firms

(Other Contracts on Page 682j)

Contractor	Gov't Agency	Commodity	Amount
Crucible Steel Co. of America, New York, N. Y.	War	Shot	$113,236
Motor Wheel Corp., Lansing, Mich.	War	Shell	67,108
Continental Motors Corp., Muskegon, Mich.	Navy	Engines	1,112,275
Douglas Aircraft Co., Inc., Segundo, Calif.	Navy	Airplane parts	13,639
Douglas Aircraft Co., Inc., Santa Monica, Calif.	Navy	Airplane parts	53,869
American Bantam Car Co., Butler, Pa.	War	Trucks	173,070
Ford Motor Co., Detroit, Mich.	Procurement	Trucks	1,150,920
American Locomotive Co., New York, N. Y.	War	Artillery carriages	1,132,200
United Shoe Machinery Corp., Boston, Mass.	War	Guns	1,316,485
General Electric Co., Schenectady, N. Y.	War	Howitzers	201,090
Variety Aircraft Corp., Dayton, Ohio	War	Stand assemblies	177,500
Crucible Steel Co. of America, New York, N. Y.	War	Forgings	177,098
National Forge & Ordnance Co., Irvine, Pa.	War	Forgings	65,500
Struthers Wells-Titusville Corp., Titusville, Pa.	War	Forgings	63,500
American Brake Shoe & Foundry Co., Chicago, Ill.	War	Shell forgings	160,500
Colt's Patent Fire Arms Mfg. Co., Hartford, Conn.	War	Parts for pistol	40,330
Heppenstall Co., Pittsburgh, Pa.	Navy	Forgings	166,344
Bethlehem Steel Co., Bethlehem, Pa.	Navy	Forgings	1,066,738
Camden Forge Co., Camden, N. J.	Navy	Forgings	134,877
Struthers-Wells-Titusville Corp., Titusville, Pa.	Boston Navy Yd.	Forgings	22,113
Revere Copper & Brass Inc., Baltimore, Md.	War	Cartridge discs	1,017,433
International Harvester Co., Washington, D. C.	Navy	Tractors	132,137
Diamond T. Motor Car Co., Chicago, Ill.	War	Trucks	3,249,414
Corbitt Co., Henderson, N. C.	War	Trucks	1,396,664
General Motors Corp., Cleveland, Ohio	Navy	Propelling machine	5,732,476

Inventors Council May Persuade Congress To Appropriate $150,000

WASHINGTON—That new National Inventors Council is going to get $150,000 to run on—if the Department of Commerce can persuade Congress. The patent office, which is in the Department of Commerce, has as its chairman, Charles Kettering. This council will examine all the unsolicited bright ideas, and will also farm out perplexing defense problems to the country's known capable inventors and research organizations. Some of the funniest dinguses on earth are on file with the Army and Navy and Aeronautics Advisory Committee, and the Patent Office. But they won't tell you about them because they are afraid people might laugh. Wacky inventors are not to be discouraged because they are the ones who create the telephones, the submarines, the airplanes, rubber tires, steamboats. Just one such stroke of genius might tip the scales of a war.

INSIDE DETROIT

New 1941 cars lean toward torpedo-styling. General Motors uses it exclusively. More power, greater economy for engines; transmissions improved with regard to gear clashing, ease of shifting

BY RUPERT LE GRAND, DETROIT EDITOR

DETROIT—Enough has been seen or learned of 1941 models to provide a broad picture of improvements to be offered a car-hungry public There won't be many "tremendous surprises", and many of the important changes have been mentioned during recent months But by and large, most manufacturers have made a real effort to provide passenger cars that are more attractive, roomy, powerful, responsive, and easier to drive than outgoing models, plus numerous detail refinements that increase comfort, safety and reliability of service

In short, despite price tags that may be three to five per cent higher to compensate for the rise in cost of materials and labor, 1941 models truly offer that extra yearly measure of value for which the automobile industry is famous There has been no attempt to stint because of unsettled world conditions or preoccupation with national defense

At first glance, the most striking thing about many 1941 models is adoption of Torpedo styling almost lock, stock and barrel General Motors, originator of the torpedo body, will offer it exclusively, including a new version, on Pontiac Oldsmobile and Buick There is also the strong possibility that Chevrolet will again take the bull by the horns and do something unusual in the mass market Witness the Special Deluxe of 1940

Nash Favors Torpedo Type

All three Nash lines are torpedo-type, including the new entry into the low-price field—the Ambassador 600. Studebaker has a new Land Cruiser Model and now offers the purchaser of Commanders or Presidents a choice of conventionalized or torpedo styling And as said previously, Hudson revised the rear-quarter of its bodies to achieve the Torpedo silhouette Willys has a larger and more handsome car and will put a new name on it for the coming year

The remainder of the field—Chrysler, Ford and Packard—seemingly prefer to continue evolution of body lines along the courses indicated in 1940 or earlier. Retention of visible runningboards on Chrysler products leads to the opinion that bodies have not been widened to torpedo dimensions, although it is believed that airflow principles will be considerably more evident Packard's smaller cars retain runningboards, are apparently about one inch wider through the body compartment Ford men have been enthusiastic about the styling evolved for Lincoln Zephyr and used in various degrees on Ford and Mercury models This enthusiasm, plus acknowledged functional design and the comparatively short model-changeover period make it appear that Ford products will be brightened externally and internally and the frontal appearance will be modified

Others Use Torpedo Styling

Two versions of torpedo styling will be used on the Buick, Oldsmobile and Pontiac lines for 1941 The conventional narrow body with exposed running boards has disappeared All three makes utilize trunk-back torpedo styling revised somewhat from last year, and a new fast-back torpedo, in which the roof-line curves sharply from the windshield to the rear bumper without a trunk protuberance Buick uses the fastback torpedo body on its Special whereas Pontiac has made it the middle-priced model, and it is believed that Oldsmobile will do likewise

LARGE PROCUREMENT ORDERS

DETROIT—Procurement orders for large quantities of war material are expected to shower down upon Michigan auto and parts plants within the next month or six weeks Orders for more tanks shell, and 700 Packard marine engines for mosquito boats are in the offing, plus new items like cannon Most imminent, however is a contract for at least 25,000 machine guns which may be placed before this is published Likely recipient Saginaw Steering Gear Division General Motors already has an educational order for 500 machine guns, spent one-fourth of the $750,000 allotment for new machine tools



Merry-Go-Round Conveyor—*Not all the improvements in the auto industry are made on cars. Among numerous new equipment installations in the Lincoln $1,000,000 body plant is a 250 ft. conveyor for clamping and assembling the components of side frames for the Lincoln-Zephyr*

U. S. Government Contracts Awarded to Tool Makers

(Defense Contracts on Page 688)

Contractor	Gov't Agc	Comi	
Henry Vogt Machine Co Louisville, Ky	War	Machined shell	$185,155
Allis-Chalmers Mfg Co Milwaukee, Wis	Navy	Housing forgings	82,720
National Forge & Ordnance Co, Irvine Pa	Navy	Gun forgings	591,309
General Machinery & Supply Co, San Francisco, Calif	Navy	Cham hoists	13 701
Warner & Swasey Co Cleveland, Ohio	War	Turret lathes	63,420
Judson-Pacific Co, San Francisco, Calif	Interior	Traveling cranes	64,920
Perine Machinery & Supply Co, Seattle, Wash	Navy	Boring mill	22 957
Rockford Machine Tool Co Rockford Ill	Navy	Planers	19 088
Lloyd & Arms Inc, Philadelphia Pa	Navy	Radial drills	17 230
Waterbury Farrel Foundry & Machine Co, Waterbury Conn	War	Cartridge loading machine	11,500
Brown & Sharpe Mfg Co Providence, R I	War	Milling machines	38,433
National Broach & Machine Co Detroit, Mich	War	Milling machines	102 560
Kingsbury Machine Tool Corp, Keene N H	War	Drilling machines	21,133
The Lapointe Machine Tool Corp Hudson, Mass	War	Sharpening machines	10 066
Henry Prentiss & Co Inc, New York, N Y	War	Surface grinders	21,699
	War	Drilling machine	12,626
	War	Turret lathes	21 212
Jones & Lamson Machine Co, Springfield, Vt	War	Thread grinder	14 519
Lloyd & Arms Inc Philadelphia Pa	War	Engine lathes	20 185
The National Acme Co, Cleveland, Ohio	War	Screw machines	56,524
Kearney & Trecker Corp, Milwaukee Wis	War	Threading machines	37,450
National Twist Drill & Tool Co, Detroit, Mich	Navy	Twist drills	71,053
Builders Iron Foundry, Providence R I	Navy	Rifling machine	14,500
Ingersoll-Rand Co, Knoxville Tenn	TVA	Core drills	29,400
Gould & Eberhart Newark, N J	Navy	Gear cutting machines	21,593
William Sellers & Co Inc, Philadelphia Pa	Navy	Machine traverse radial drilling	45,805
Lodge & Shipley Machine Tool Co Cincinnati, Ohio	Navy	Engine lathes	25,509
Cincinnati Milling Machines & Cincinnati Grinders Inc, Cincinnati Ohio	War	Milling machines	75 900
Taylor Parker Co, Norfolk Va	Navy	Twist drills	16,202
Hendey Machine Co, Torrington, Conn	War	Lathes	18,800
Landis Tool Co, Waynesboro, Pa	War	Grinding machines	23,670
EnterpriseTool & Gear Corp Detroit, Mich	War	Gears	52 012
Mine Safety Appliances Co Pittsburgh, Pa	Navy	Power presses	18,280
The American Tool Works Co Cincinnati, Ohio	Navy	Engine lathes	30,146
Bullard Co, Bridgeport Conn	Navy	Vertical lathes	26,142
Modern Tool & Die Co, Philadelphia, Pa	War	Gages	18,225
Ster-Bath Co Inc, New York, N Y	War	Gears	24,667
Detroit Bevel Gear Co, Detroit, Mich	War	Gears	17,052
Van Dyck Churchill Co, New York, N Y	War	Turning machines	77,565

Pontiac and Olds will follow almost identical policies for 1941: three torpedo models, two wheelbases, and optional use of a six or eight cylinder engine in any model or wheelbase. Pontiac apparently will use 119 and 122 in. wheelbases; Olds, 119 and 126. The 116 in wheelbase has been dropped from both lines Plymouth had the longest wheelbase in its price class during 1940, and it is likely that both Chevrolet and Ford will lengthen the chassis by two or three inches in order to meet that competition, and to get out of the immediate neighborhood of the Studebaker Champion and Nash Ambassador 600.

In the Ambassador 600, Nash has a sensational entry into the low price field. The car has 112-in. wheelbase, but is 194 in. over all.

More power, greater economy and snappier response will be almost universal in 1941 engines because of improvements made feasible through the new higher-octane fuels to be marketed this fall. Improved carburetion, somewhat higher compression, improved combustion chamber design and better engine bearings are means of accomplishing the above ends. Buick captures the stage with its "fireball eight" coined to denote the flame propagation characteristics of its engines, which introduce compound carburetion for the first time in production eight-cylinder motors

General Motors will not be alone in the use of better engine bearings Chrysler products, judging by the Plymouth, will have new bearings with thin babbitt linings in heavy steel backings, a relatively difficult attainment.

Transmissions have been improved with regard to gear clashing and ease of shifting. General Motors will continue the Hydramatic drive in improved form on Olds as optional equipment and offer it also on the Cadillac group. Chrysler will make the fluid drive available on the Chrysler six, DeSoto and Dodge, and press releases might be construed as including the Plymouth in the not too distant future. DeSoto announces the Simplimatic Drive, which is probably the vacuum-operated semi-automatic transmission mentioned previously. This drive in combination with the fluid drive, will accomplish most of the things possible with the full automatic transmission, but probably cost less.

MACHINERY EXPORTS DECLINE

WASHINGTON — Exports of power driven metal-working machinery amounted to $14,906,312 for the month of July. This was a 20 percent decline from the total for the month of June. Exports of lathes dropped from $3,869,946 to $2,377,133; drilling machines from $1,176,998 to $844,539, and rolling mill machinery decreased from $2,884,832 to $1,006,770 in June. Exports of milling machines and grinders were about the same in each period. Shipments of metal-working machinery, other than power driven, were valued at $582,087 in July, a slight decline from the June figure

Gov't Field Procurement Offices Simplify Placing of Contracts

WASHINGTON—A great many defense orders have been awarded recently by the various Field Procurement Planning Offices of the War Department. Such items as ammunition, weapons, fire control instruments, tools, machinery, and supplies used in arsenals and for maintenance of ordnance have been purchased through these field offices and at the same time have obviated the necessity of manufacturers coming to Washington The field offices are in the following Army Ordnance Districts:

Baltimore, Md.—Purchases Baltimore area — being handled through Philadelphia.

Birmingham, Ala —302 Comer Building.

Boston, Mass.—2004 Post Office and Court House Building

Chicago, Ill.—309 West Jackson Boulevard.

Cincinnati, Ohio—521 Post Office Building.

Cleveland, Ohio — 1524 Keith Building.

Detroit, Mich. — 611 Federal Building.

Los Angeles, Calif —Army Ordnance Office, 409 Chamber of Commerce Building.

New York, N. Y.—Room 1214, 90 Church Street.

Philadelphia, Pa.—1417 Mitten Building.

Pittsburgh, Pa.—1032 New Federal Building.

Rochester, N. Y.—1118 Mercantile Building.

St. Louis, Mo.—935 Customhouse.

San Francisco, Calif.—118 Federal Office Building

Springfield, Mass.—3640 Main Street.

Wilmington, Del.—Army Ordnance Office, Nemours Building (for explosives only).

NAMES in the NEWS

Howard M. Hubbard has been elected president of Greenfield Tap & Die Corp., Greenfield, Mass. Mr. Hubbard replaces D. G. Millar, who resigned as president to become chairman of the board. For the last ten years Mr. Hubbard has been associated, as secretary-treasurer, with the Harris-Seybold-Potter Co. Francis A. Smith, for several years vice-president and general manager, has resigned from active service in the Corporation.

John H. Stapleton has been named assistant manager of sales for the New York district of Carnegie-Illinois Steel Corp., Pittsburgh, Pa. Mr. Stapleton has been associated with the Carnegie subsidiaries since 1917.

Merle C. Nutt succeeds his father, L. E. Nutt, as president of Moline Iron Works, Moline, Ill. Mr. L. E. Nutt has been named chairman of the board.

John R. Haysak has been named vice-president in charge of factory management of Ferry Cap & Set Screw Co., Cleveland, Ohio.

G. S. McKee, production manager of Talon, Inc., Meadville, Pa., has been elected a director of the Hall Planetary Co. of Philadelphia.

Floyd Stroup is now superintendent of the melt department of Copperweld Steel Company's new plant at Warren, Ohio.

Carroll F. Brown has been appointed superintendent of industrial relations at the Duquesne Works of Carnegie-Illinois Steel Corp.

Herman J. Hofmann, assistant open hearth superintendent of Lukens Steel Co., Coatesville, Pa., since April, 1926, has been promoted to open hearth superintendent, succeeding J. D. Walters who has resigned.

John P. Davey, chief of production planning at the Curtiss Aeroplane Division of Curtiss-Wright Corp. in Buffalo, has been transferred to the company's plant in St. Louis to develop expanding operations there.

J. A. Butler has been appointed comptroller of the Falk Corp., Milwaukee, Wis.

R. Volbrecht has been appointed to the New York merchandising sales staff of Cutler-Hammer, Inc., Milwaukee, Wis.

F. J. Geiger has been named assistant manager of the electrical department of Allis-Chalmers Mfg. Co. In this capacity Mr. Geiger will be in complete charge of sales and engineering at the company's Norwood, Ohio, plant. Frank R. Freyler has been named to succeed Mr. Geiger as assistant manager of sales and E. C. George and A. Thorsen have been respectively named to the posts of acting works manager and assistant works manager.

Wins Promotion *New Traffic Manager* *Elected President*



JOHN H. STAPLETON ELWOOD G. STEWART H. M. HUBBARD

Elwood G. Stewart, who has been acting traffic manager since November 1939, has been appointed traffic manager of the concern. Mr. Stewart had been assistant traffic manager since May 1935.

Ralph O. Wirtemburg, formerly manager of the New York office, New Departure Division, General Motors Corp., has been appointed eastern sales manager. Francis B. Wasley has been named to succeed Mr. Wirtemburg in New York. Mark Goedecke has been named to succeed Mr. Wasley in Philadelphia.

J. L. Wagoner has been promoted to agency sales section manager for the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

PLANT EXPANSION

Sterling Engine Co., Buffalo, N. Y., manufacturer of marine engines, will erect a test-room addition to its plant.

Lockheed Aircraft Corp. is erecting a new research building at its plant in Burbank, Calif.

Ryan Aeronautical Co., San Diego, Calif., is erecting a $75,000 addition to its factory on an area of 26,280 sq.ft.

United Aircraft, East Hartford and Stratford, Conn., will further expand its plants at an estimated cost of $15,000,000. Another large addition to the Pratt & Whitney aircraft engine factory in East Hartford is planned. This will bring its total floor area to approximately 1,500,000 sq.ft.

The Holo-Krome Screw Corp., Hartford, Conn., is completing a factory addition to its plant in Elmwood.

Douglas Aircraft Co., Santa Monica, Calif., will erect a new aircraft manufacturing plant at Long Beach, Calif. This recent addition is a part of a program which includes extensive additions and improvements to the company's plants which is scheduled to cost more than $20,000,000.

Following the government approval of a $34,000,000 loan to Curtiss-Wright Corp. the construction of an airplane plant in Buffalo is considered a certainty. Expenditures may range between $8,000,000 and $10,000,000.

BUSINESS ITEMS

Willard Tool Co., Bridgeport, Conn., has been acquired by the Auto Ordnance Co., New York.

Bumstead-Woolford has been appointed exclusive sales representatives for the Oregon and Washington territory for the Foxboro Co., Foxboro, Mass.

The Ohio Gear Co., Cleveland, Ohio, has been appointed national distributors for the products of the Browning Mfg. Co., Maysville, Ky.

Vultee Aircraft, Inc., has acquired the properties of the Stinson Division of the Aviation Mfg. Corp., which consists of a new factory in

Dies at 54



TYLER W. CARLISLE

Passes Away



WALTER P. CHRYSLER

Nashville, Tenn., and a plant at Wayne, Mich. Harry Woodhead, president of the Aviation Mfg. Corp., has been elected chairman of the board of Vultee Aircraft Inc.

Bullard Co., Bridgeport, Conn., manufacturer of machine tools, is beginning the construction of two new plant units.

The Dayton Rogers Mfg. Co., Minneapolis, Minn., is expanding their plant at Minneapolis by adding a new one-story factory building. The new addition will house new machinery and other special equipment.

OBITUARIES

Walter P. Chrysler, for many years president and chairman of the board of the Chrysler Corp., died recently at the age of 65. In 1916 Mr. Chrysler was president and general manager of Buick and early in 1919 first vice president of General Motors Corp. in charge of operation.

In 1908, at the age of 33, Mr. Chrysler bought his first automobile. However, he did not buy the car to operate. He bought it to study, to take apart and put together again several times. Sixteen years later he built the first car to bear his name.

In 1919 Mr. Chrysler resigned with the intention of retiring. However, he couldn't remain inactive long and soon accepted the position of executive vice president and general manager of the Willys-Overland Co. which was then involved in serious financial difficulties. Within two years he placed this company's business on a sound basis.

Since June 1925 when the Chrysler Corp. was formed to its fifteenth birthday in 1940, Chrysler Corp. had sold more than 8,000,000 Plymouth, Dodge, DeSoto and Chrysler cars and Dodge trucks. In 1930 the 77-story Chrysler building, named after Mr. Chrysler, was opened in New York City. Mr. Chrysler was a member of the Society of Automotive Engineers.

Tyler W. Carlisle, president, The Strong, Carlisle & Hammond Co., Cleveland, Ohio, died recently at the age of 54. For over 25 years Mr. Carlisle had been actively identified with the growth and development of the organization. In 1916, after only six years of service, he was advanced to the position of Sales Manager and a director of the company.

Hubert C. Hart, noted inventor, died at the age of 97. Mr. Hart headed his own manufacturing company and manufactured cutlery and edged tools for 70 years.

Nelson L. Fortin, 51, district manager in Milwaukee for the Revere Copper & Brass Co., died.

James Hughes, 57, western representative for S. T. Stevens, Inc., Detroit, Mich., died recently. Mr. Hughes, a former United States Congressman, joined the Stevens company in 1915.

William L. Fewsmith, manager of publicity and advertising for Robins Conveying Belt Co., Passaic, N. J., died after a brief illness. Mr. Fewsmith first joined the company in 1913 as a civil engineer.

Charles F. Drew, secretary and treasurer of the Rust Engineering Co., Pittsburgh, Pa., died recently.

MEETINGS

American Society for Metals. Annual convention. Hotel Statler, Cleveland, Ohio. Oct. 21–25.

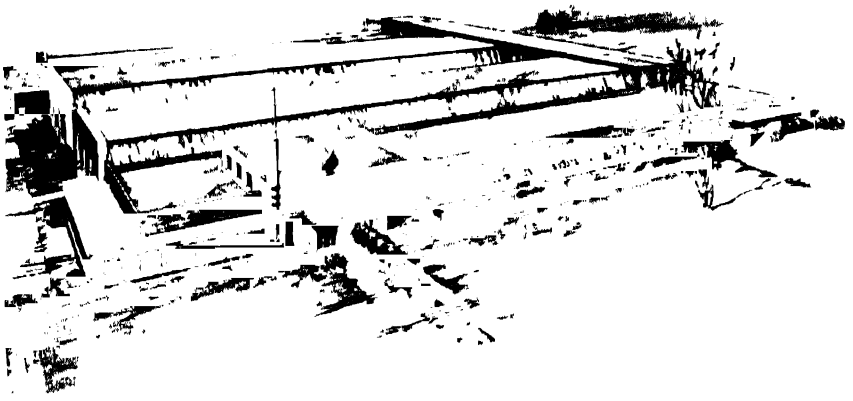
American Welding Society. Annual convention. Hotel Cleveland, Cleveland, Ohio. Oct. 20–25.

The Wire Association. Annual convention. Carter Hotel, Cleveland, Ohio. Oct. 17–23.

American Society of Tool Engineers. Semi-annual convention. Cincinnati, Ohio. Oct. 17–19.

American Gear Manufacturers Association. The 23rd semi-annual convention. Skytop Lodge, Skytop, Pa. October 14, 15 and 16, 1940.

Society of Automotive Engineers. National tractor meeting. Schroeder Hotel, Milwaukee, Wis., Sept. 24–25. Annual dinner. Hotel Commodore, New York, N. Y., Oct. 14.



Reversing Horace Greeley—*Although most eastern manufacturers are going to the west coast to build branch plants, U.S. Electrical Motors, Inc., is building a new complete production plant at Milford, Conn. Above an architect's drawing shows how the plant will look when it is finished.*

SHOP EQUIPMENT NEWS

Gleason "Revacycle" Bevel Gear Cutting Machine Finishes Straight-Tooth Pinions by New Principle

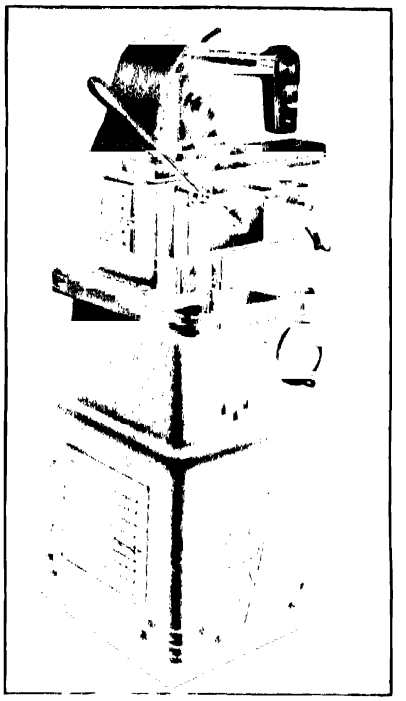
A mass production machine entirely new in principle and design developed for cutting straight-tooth bevel gears such as used in automobile differentials washing machines and textile machinery has been developed by the Gleason Works 1000 University Ave Rochester N Y Known as the 'Revacycle this machine provides an exceptionally fast method of cutting straight bevel gears as these are both roughed and finished in one operation with a single disk cutter

The machine cutter has a number of radially arranged roughing blades followed by a number of similarly arranged finishing blades with a gap between the last finishing and the first roughing blade This cutter is mounted on a reciprocating slide and as the cutter rotates in engagement with the gear blank it moves along the tooth the action being similar to that of a milling cutter As the cutter moves from the small to the large end of the blank the roughing blades cut out a tooth space On the return stroke the finishing blades finish the tooth space which has just been roughed The blank is held stationary during cutting and at the end of each return stroke of the cutter the blank is indexed at the gap in the cutter blades Each revolution of the cutter completes a tooth space Conjugate tooth forms are produced as a result of the cutter motions and the shape of the cutter blades

Except for chucking operation of the 'Revacycle is entirely automatic There are no chucking delays however as the machine is provided with a rotary work-holding turret with three spindles Thus gears are removed and blanks loaded at two stations while cutting takes place at the third Turret indexes automatically

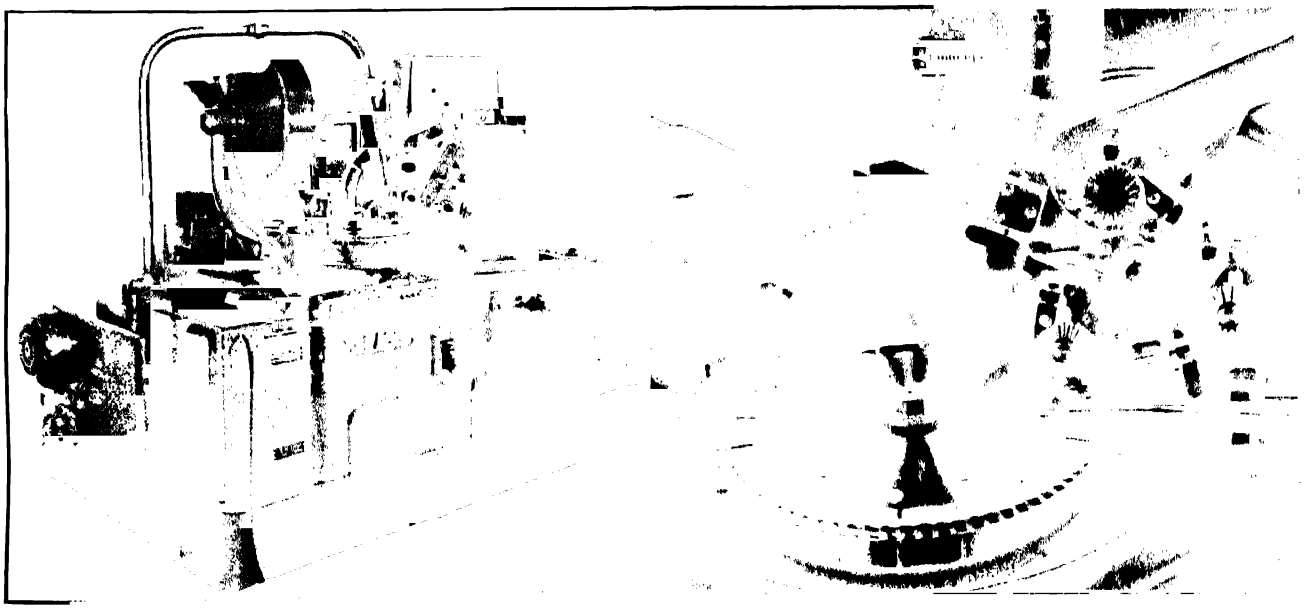
Cutter spindle is rigidly mounted on precision anti-friction bearings with provision for periodic greasing Lubrication of all moving parts other than the spindle is provided by a circulating oil system Work is held in place by a heavy spring and is released by a hydraulic piston Clamping takes place automatically when the blank is properly chucked releasing is also automatic Index for the work spindle is of the notched plate type with hardened and ground index plates A built in conveyor deposits chips outside the machine Included is a hydraulic unit which supplies power for clamping the turret for chucking the blank and for operating the chip remover

Specifications Maximum cone distance 3 in maximum face 1¼ in coarsest pitch limited by maximum whole depth of 0 450 in , ratios 1 1 to 2 1 pitch diameters from 2¼ in to 5¹ in , index range from 8 to 40 teeth



Vernon Hand Milling Machine Finishes Parts at High Speed

An addition to the Vernon line of precision milling machines offered by Machinery Mfg Co 3636 Irving St Vernon Los Angeles Calif is the No 0 hand miller for high speed milling of small parts With hand lever operated rack and pinion feed this machine is a precision tool providing the accuracy and sturdiness re-



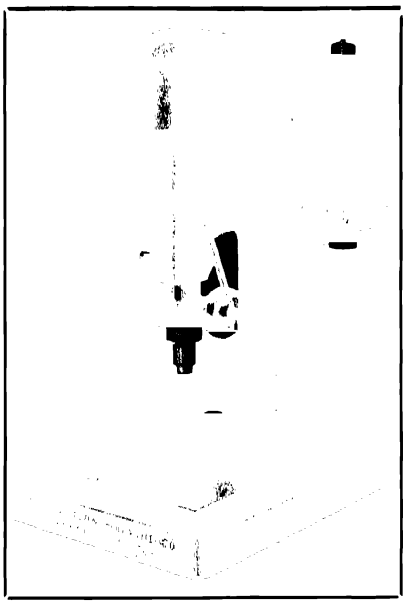
quired for modern output methods.

Two standard speed ranges are available—100 to 1,000 r.p.m., and 150 to 1,500 r.p.m. Variable drive is fully inclosed. Heat-treated and ground spindle is mounted on Timken tapered roller bearings. Power is provided by a ½-hp., 1,750 r.p.m. motor. Over-all height of this tool is 58 in. Net weight is about 650 lb

Reed Sensitive Bench Drill Has No Exposed Moving Parts

Production Machine Co., Greenfield, Mass., has made available a high-speed sensitive bench drill which has no exposed moving parts other than the drill itself. A development of the Reed line of sensitive drills which Production Machine Co. is now building, this No. 25 drill is claimed to have unusual strength and to be unique in its simplicity. It has been designed as a production tool for accurate work, and as an all-purpose machine capable of unusual speed and adaptable to a wide variety of drilling operations.

Variable speed drive, completely enclosed, provides an infinite number of spindle speeds ranging from 2,000 to 10,000 r.p.m., instantly available by turning a handwheel. An indicator shows the running speed.



Specifications: center of spindle to column, 7 in.; maximum distance from chuck nose to table, 6 3/16 in.; adjustment of sliding head, 3 in.; maximum spindle travel, 3¼ in.; drill sizes, No 70 to ½ in. Motor delivers ½ hp at 110 volts, single phase, 60 cycle, 3,450 r.p.m. Spindle is carried in two sealed precision ball bearings. Weight complete is 195 lb.

Cleveland 5-Ton Cantilever Cranes Permit Handling Loads in Adjacent Bays

Cleveland Crane & Engineering Co, Wickliffe, Ohio, has built two cranes of special construction which are designed materially to reduce handling time between bays. These cranes have a cantilever extension which makes it possible for the trolley to go beyond the crane runway and convey loads into the adjacent bay. The crane bridge is underslung to permit the trolley to clear the runway girder.

Construction is of all-welded steel throughout, with all bearings of the anti-friction type Spring-type bumpers are provided for the trolley and one side of the bridge Gear cases are oil tight Bridge wheels, gears, and pinions are all of tool steel

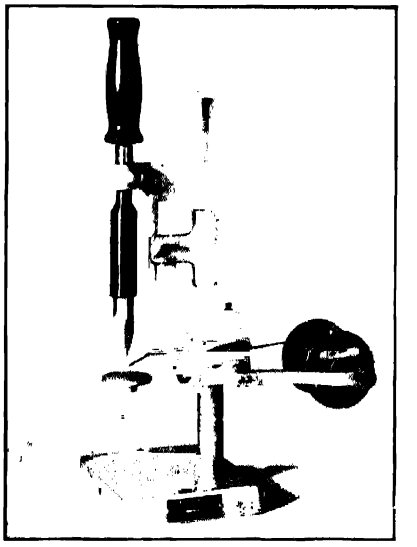
Cranes are operated from a closed-type cab mounted on one end of the bridge opposite the bridge extension. Capacity of each crane is 5 tons, with a span of approximately 37 ft. Vertical travel of hook is 86 ft. Hoisting speed is 40 ft. per min., trolley speed is 100 ft. per min., and bridge speed is 350 ft. per min.



Spot Soldering Machine Leaves Both Hands Free

A spot soldering machine for use in places where both hands are necessary to hold the parts together has been developed by Electric Soldering Iron Co., Deep River, Conn Any industrial soldering iron may be used with the device.

Machine is operated by a treadle which advances the iron straight down. Contact of iron tip with work is cushioned by a spring suspension.



As iron returns from work, solder is automatically fed forward. Feeding of solder may be accurately regulated by adjustment of pawl lever which engages feeding gears. Solder of any diameter up to ⅛ in. may be used Solder feed tube is adjustable to guide solder to any desired point. Shipping weight of the device, complete with chain and treadle, but without iron, is 13 lb

Tap Grinding Attachment Can Be Set Up Quickly

Quick set-up for chamfer sharpening of many styles of taps is one of the features of the No 2 tap grinding attachment offered by Covel Mfg. Co., Benton Harbor, Mich. This attachment is easily mounted on any grinding machine having a wheel of 1¼-in. face or less, and having longitudinal and transverse adjustment similar to a universal cutter and tool grinder, with a flat table 4½ to 6¼ in. wide.

No cams, gears or collets are required to hold the tap or to get proper eccentric relief. Small taps, from the No. 6 to the ½-in., are held



in a three-jaw chuck, while larger taps are held on centers. Spindle is mounted in dust-protected ball bearings.

In operation the attachment is set up and securely fastened to the grinding machine, then adjusted for the kind and size of tap to be ground. The face of the flute is aligned with a lip rest and the amount of eccentric relief adjusted. Grinding is accomplished by rocking a knob back and forth, movement of which is limited by stops.

For a maximum of ease and accuracy, the oscillating spindle revolves in ball bearings, so that the operator can feel the cut of the grinding wheel. When one tooth has been ground, operator indexes the tap to the next tooth by locating it from the lip rest. The lip rest is adjustable for large and small, or right- and left-hand taps.

Lees-Bradner Heavy Thread Milling Machine Especially Adaptable to Munitions Production

The Model CT chucking type heavy thread milling machine introduced by the Lees-Bradner Co., 6210 Carnegie Ave., Cleveland, Ohio, is arranged for the generation of threads by means of the ring type or hobbing process, using either shank or shell type cutters. Having a 13-in. hole through the work spindle and a swing over the ways of 24 in., this machine is adapted for the threading of propeller blades, propeller hubs, breech blocks, gun barrels, landing gear components, and other similar parts of considerable size which require the utmost in precision threading.

Machine is driven by two motors, the cutter drive motor being mounted directly on cutter head, and the work head motor being mounted partly in the base. A separate motor-driven coolant pump is furnished. Through the use of the two main driving motors, the long cutter head drive shaft often employed is eliminated.

Control is through pushbuttons; the two main driving motors are electrically interlocked so that the headstock motor cannot be operated unless the cutter is rotated. Cutter head traverse is controlled by limit switches; stops for actuating these switches are at the front of the machine readily available for adjustment. Control of direction of rotation of the two main driving motors is through reversing drum switches conveniently located at the front of the machine. Drive from both motors is through V-belts; both drives are completely enclosed.

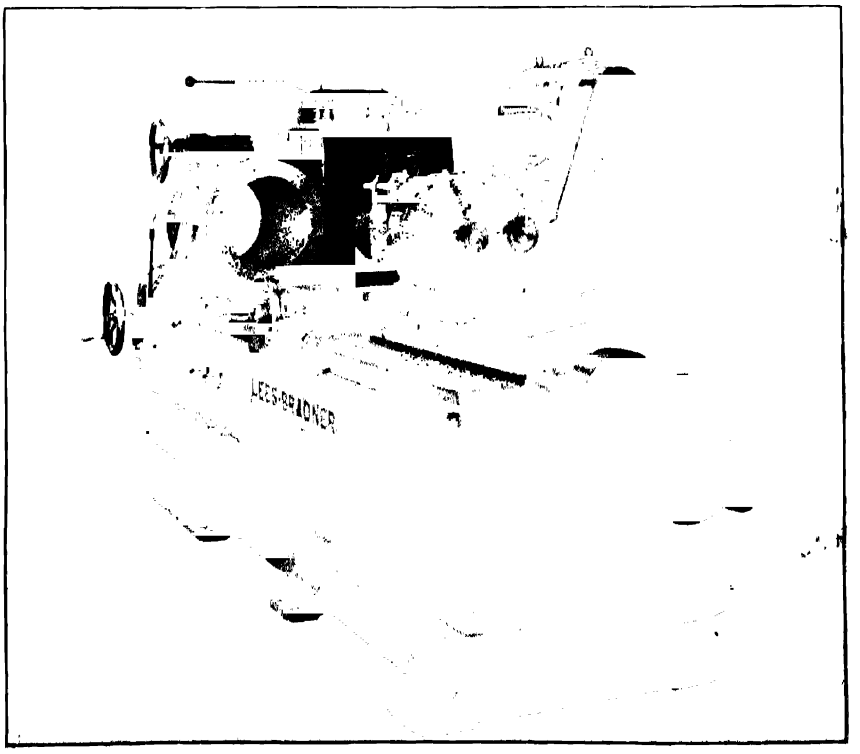
Work spindle, driven by a precision worm and worm wheel, is arranged for the installation of various types of work holding fixtures such as collets, three or four jaw chucks, or special fixtures. Spindle rotates in large hand scraped, hard bronze bearings. Lead gears and feed gears are independent of each other. Since many of the threads of the sort which are generated on this machine must register angularly and axially, provision has been made for adjusting the work spindle and cutter carriage independently through large handwheels which are located on the headstock.

Extreme rigidity has been built into the cutter head of the machine. It is designed for use with ring type thread milling cutters of either the shell or shank type. Cutter spindle is provided with a No. 12 B&S taper and is drilled to permit the use of a draw rod to securely seat the cutter. Cutter spindle, of hardened and ground alloy steel, runs in hand scraped, hard bronze bearings. Cutter head is arranged with a two-speed gear box and with pick-off gears, which together give a total of 18 cutter speeds. Bearings are of the anti-friction type, with the exception of the main cutter spindle bearings.

Three methods of traversing the cutter head are available. By the use of the hand traverse the cutter head can be accurately positioned longitudinally in relation to the work spindle. When threads registered in relation to the part are generated, this fine hand adjustment is particularly valuable. The power operated traverse moves the cutter toward or away from the work spindle but maintains the relation of the cutter to threads which have already been generated. This is of value when the machine is being set up on a job, or when roughing and finishing cuts are desired. By its use a thread can be generated, the cutter backed away from the thread, the thread gaged and the cutter then brought back into engagement with the thread for a second cut. The third rapid traverse mechanism, available as an extra, employs a motor arranged with a solenoid operated brake and is useful for rapidly traversing the cutter toward or away from the work spindle. These power rapid traverse mechanisms have pushbutton and adjustable stop control.

Machine is arranged with an automatic depth stop. A precision micrometer screw and an accurately graduated dial reading in thousandths of an inch permit depth of cut to be accurately adjusted. Once this proper depth is obtained, a positive mechanical stop is set. Use of this automatic depth stop on subsequent cuts assures duplication.

Although the machine is arranged primarily for chucking work, it can be supplied with a swiveling cutter head and a tailstock for work to be



done on centers. When the machine is so arranged, threading can be done with either ring or disk cutters.

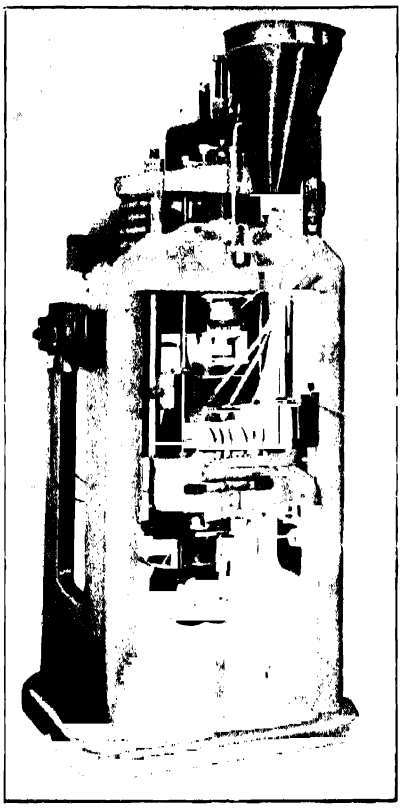
Plastic Molding Machine Forms Threaded Parts

By means of an automatic unscrewing device built into the automatic molding press made by the F. J. Stokes Machine Co., 5930 Tabor Rd., Philadelphia, Pa., threaded plastic parts can be produced in a completely automatic operation at production rates of over 1,000 per mold cavity per day.

Standard machine threads, internal or external, of any desired pitch may be molded, the speed of the unscrewing device being readily adjustable to that of the pitch of the thread. Ejection is positive and takes place at the same time the mold is opening. Thus there is no loss of time or lengthening of the cycle.

By mounting separate molds in the machine and charging each mold individually, one, two and three threaded moldings can be made simultaneously. Single, double or triple powder feed mechanisms are provided to charge each mold with an accurately metered amount of material.

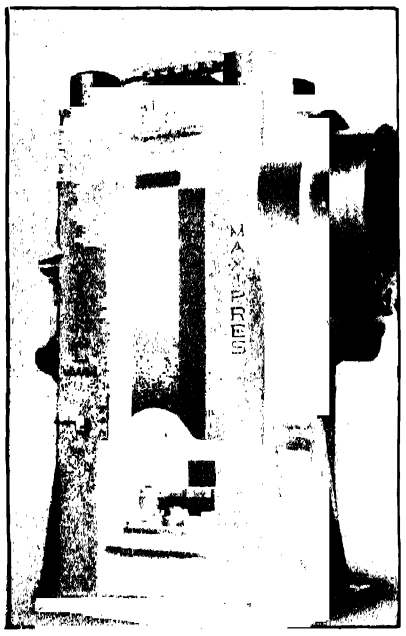
Machine, being completely automatic, requires no operating attention, except to refill the hopper with molding powder and remove finished parts. Since several operations are



performed simultaneously the molding cycle is short. A positive type mold practically eliminates flash and saves molding material and finishing costs. Large output per cavity reduces mold cost per piece.

National High Speed Forging "Maxipres" Developed for Wide Variety of Work

National Machinery Co., Tiffin, Ohio, has developed a new line of high speed forging "Maxipreses" suitable for a great variety of forging work.



With these units, forgings are made in two or three blows which formerly required many additional blows. Better metal flow is said to enable forgings to be made with less flash and less weight of stock than customary, and the extra rigidity is claimed to cause the moving die to come to its extreme bottom position at each stroke so that only one blow is necessary for each die impression. Since impact is reduced, it is feasible to use insert dies, reducing cost and making possible the use of superior quality die steel. With these presses no particular skill is required on the part of the operator.

To obtain high speeds, drive of the presses has been radically changed. The No. 6 model illustrated, which corresponds to a 5,000-lb. steam hammer, or a 6500-lb. board drop hammer, operates at 80 strokes per min. This has been accomplished by transferring the driving clutch from the back gear shaft directly to the crankshaft. Thus there is less dead weight to start and stop, and less power is consumed. An air cylinder working on the upstroke assists in stopping, and provides air for the clutch. This greatly reduces the contact time between dies and the hot stock, and materially improves die life.

Additional refinements have been incorporated in the construction of these presses to increase their stiffness. One of these is a double wedge construction for supporting the bottom die, which minimizes deflection of the die under the forging pressures encountered.

These "Maxipreses" are built in six sizes from No. 1½ to No. 6, corresponding in capacity to 800, 1,200, 2,000, 3,500, 5,000 and 6,500 lb. board drop hammers. They have operating speeds ranging from 130 strokes per min. on the small size to 80 strokes per min. on the large size. The No. 6 press illustrated weighs 300,000 lb. and has a ram face area of 42x42 in.

Service Portable Die Lifter Performs Three Operations

A portable lifter combining three die-handling operations in one has been made available by Service Caster & Truck Co., 635 N. Brownswood Ave., Albion, Mich. With this unit, dies can be taken from or replaced in the storage shelf, transported from storage to press, and placed in or removed from the press.

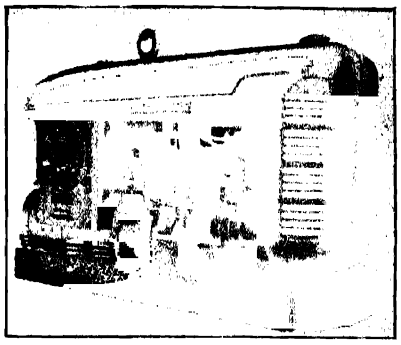
When taking dies from storage, the



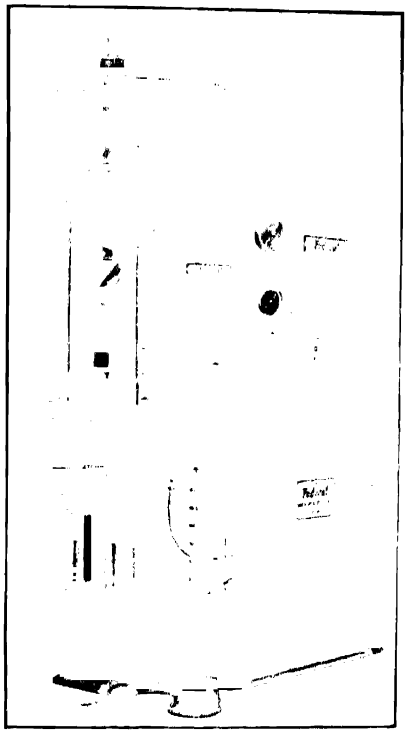
lifter is wheeled up to the rack and the platform elevated to the proper level. A steel cable, running from a winch inside the frame, is pulled out and attached to the die with a nut and bolt. The operator, standing on the floor, turns a crank which pulls the die from the shelf to the lifter's roller platform, and the platform is lowered to a convenient carrying position. After the machine has been wheeled to the press, a few turns of the crank raise the die to the press bed, where it is pushed off to the proper position.

Unit is powered with a hand-operated lifting unit with two lifting

speeds. Lowering is controlled by a heavy-duty flyball governor. Platform is lifted by twin roller chains. Capacity of the machine is 4,000 lb. Overall height is 8 ft.; total lift is 5 ft. 8 in. Lowered height of the platform is 11 in. Platform measures 36 in. from uprights and is 30 in. wide. Base width is 30 in. A worm gear safety hinge permits folding over the top half of the machine to pass through doorways.



Federal Heavy-Duty Projection Welder Features Hydraulic, Air or Motor Operation



A heavy-duty projection welder, which may be furnished for hydraulic, air or motor operation, has been developed by Federal Machine & Welder Co., 212 Dana Ave., Warren, Ohio. Illustrated is the direct hydraulically operated Model P-4 machine.

This model has a two-pressure pump, which gives high-speed operation using a comparatively small motor. Low pressure is used to bring the slide down until the electrodes contact the work. Then the machine is automatically thrown over to high pressure for performing the welding operation. When welding cycle is completed the head is returned by low pressure.

Hydraulic circuit is designed with means for adjusting both high and low pressure so that proper pressure for a given job may be applied. An adjustable pressure switch operates the timer, thus allowing a predetermined pressure to be set. It also insures holding the timing circuit off until the required welding pressure is built up.

This machine is offered in five transformer capacities, ranging from 250 to 600 kva. A four-point regulator switch is mounted on the side of the welder to give eight steps of heat regulation.

Stroke of the welding slide is adjustable from 1 to 4 in., and the lower combination knee and platen has an 8-in. vertical adjustment by means of three jack screws.

Cooling facilities have been provided in the secondaries, platens and electrodes. Both upper and lower platens are 14 in. square and are fitted with T-slots.

For work requiring a quick follow-up, thus making the heavy slide as used on a machine of this type unsatisfactory, the welding slide may be fitted with a low-inertia head built in the slide and controlled by an air cylinder, which eliminates the weight applied to the electrodes.

Hobart Announces 200-Amp. Gas Engine Driven Welder

Some 1,000 combinations of voltage and welding current are possible from the 200-amp. "Streamliner" Junior gas-engine driven arc welder developed by Hobart Bros. Co., Hobart Square, Troy, Ohio. Powered by a 26-hp. Hercules engine, this welder is particularly suitable for job welding shops, blacksmiths, repair shops, garages and miscellaneous metal-workers.

Oversized design, ample copper and steel, and sensible operating speeds are all said to contribute materially to lower welding costs. Known as the Model GR-202-S, this unit embodies a modern battery ignition system, electric self starter, electric fuel pumps, self-starting pushbutton and ignition lock. Also included as standard equipment are remote control of welding voltage, polarity switch, convenient power outlet plug, variable-speed governor, solid-core radiator and built-in fuel tank. All are mounted on a rigid steel base, with a sturdy lifting eye for handling with crane or hoist.

Control is by means of "Multi Range" dual control with 10 ranges of welding current and 100 steps of volt-ampere adjustment in each range. Thus 1,000 combinations of open-circuit voltage and welding current are available for any desired arc characteristic. Main range switch is of heavy copper molded in bakelite and controlled by a large hard rubber covered hand wheel. Volt-ampere adjuster is compactly built within the main switch, and is easily removed if remote control is desired. Variable engine speed provides a third method of controlling current values. Excitation is from a special built-in four-pole exciter. Unit is 64 in. long, 21 in. wide and 41½ in. high. Shipping weight is approximately 1,350 lb.

Farrel-Birmingham 2,000-Ton Hydraulic Press Permits Extrusion of Steel and Nickel Alloys

A 2,000-ton hydraulic press built by Farrel-Birmingham Co., Ansonia, Conn., can be successfully employed in the production of stainless steel, nickel alloy and ferrous rods, tubing and shapes, by the extrusion process. It is said that with this machine all the currently known stainless steels



and other special ferrous and nonferrous alloys which do not work well by rolling, welding or piercing can be extruded without difficulty.

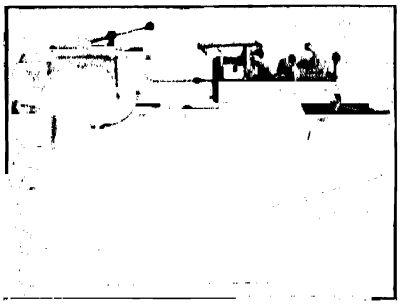
Billets to be extruded by this press can be taken as rough cast billets coming from the foundry after being cut to the proper length. Billet skin, which is formed mostly by oxidation, remains as a thin shell in the container after extrusion, so the extruded product is formed of clean material only. Tubes and rods manufactured by this press are not only remarkably sound in structure, but possess excellent metallurgical and physical properties and a good surface condition. Consequently the number of draws for finishing can be considerably reduced.

The amount of scrap—consisting of the thin shell of the billet and the discard—is very low, so the difference in weight of the billets charged into the container and of the extruded product is only about 8 per cent to 10 per cent in the case of tubes, and about 10 per cent to 12 per cent when manufacturing rods. Concentricity of the extruded tubes is well within the commercial limits, and provided that sound billets, uniformly heated, are used, is within plus or minus 5 per cent of wall thickness.

'Landmaco" Special Threading Machine Built for Extremely Accurate Work

Landis Machine Co., Waynesboro, Pa., has developed an unusually flexible type of the "Landmaco" threading machine, which is designed for handling special threading operations in which extremely close tolerances for concentricity must be maintained between the thread and the body of the work. Since such work is usually ground between centers, provision is made on this machine for supporting the work in a like manner.

Special features of this tool include a faceplate on the machine spindle



supplanting the usual die head, a special carriage front on which the die head is mounted, and a tailstock which is adjustable and which also supports the center. The faceplate, which also incorporates a live center, is employed in the same manner as the faceplate on a grinding machine or lathe, to drive the work with a dog. The special carriage supports the "Lanco" die head which is used as a stationary type head. Provision is made for opening and closing the die head with a yoke when necessary. The adjustable tailstock is clamped into position on ways located on the side of the machine bed. These ways are long enough to permit handling work ranging from 2 to 16 in. long.

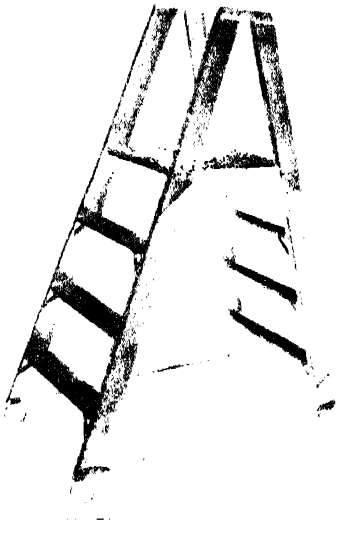
Tailstock center is advanced to or withdrawn from the work by a quick-acting lever located on top of the tailstock. Center can be clamped rigidly by means of a clamping lever also located on top of the tailstock.

This special threading machine is of the lead-screw type. Thus the thread is generated by revolving the work between centers, the die head being propelled onto the work and the thread lead being controlled by means of the leadscrew. Since the work is turned, threaded, and later ground between centers, an unusually high degree of concentricity can be maintained between the thread and the body of the work.

Double Aluminum Ladders Accommodate Two Persons

Two double or A type aluminum ladders, constructed with steps on both sides so that two persons may use the ladder at the same time, have been developed by Aluminum Ladder Co., 104 Adams St., Tarentum, Pa.

Both ladders are constructed of a special aluminum alloy having a tensile strength of 48,000 lb. per sq.in. The No. 900 is 36 in. high, has a platform measuring 12x15 in., and weighs only 13 lb. The feet are fitted with rubber pads. The No. 901, constructed of treadplate for protection against slipping, is 48 in. above the floor and has a platform measuring 19½x22 in. Side rails rise 21 in. above the platform. The ladder



measures 25x41 in. at the base, and weighs only 41 lb. complete. Illustration shows ladder fitted with 3-in. rubber casters, but any type of casters can be supplied.

Watchman's Tour System Calls Help in Emergency

Dudley Lock Corp., 325 North Wells St., Chicago, Ill., has developed a watchman's tour system which can flash or permanently record the time



of inspection and summon aid in emergencies. Said to be adaptable to every size and type of industry, it provides complete mechanical control over the watchman's activities and compels inspection of specific parts of a property at prescribed time intervals.

The system includes a number of key stations with transmitting stations at the start and finish of each series. Transmitting stations can actuate any kind of signal or recording apparatus. A special recording clock developed by Cincinnati Time Recorder Co. records date and time each transmission station is visited. An additional feature is the delayed alarm, which gives a warning at any specified location when a transmitter box is not visited within a given period.

The watchman's key is small enough to be carried inconspicuously. It consists of a combination of three separate locks, operating only on a predetermined route, and only in the proper sequence. It has a built-in cyclometer that counts the stations visited and thus gives proof of completion of specified tours.

10,000-lb. Portable Pump Supplies "Porto-Power" Rams

A portable, motor-driven hydraulic pump for supplying 10,000 lb. per sq.in. hydraulic pressure to the 4, 7, 10, 20 and 50-ton "Porto-Power" hydraulic rams, has been developed by

✓CHECKING



✓TESTING



TO MEET

Milwaukee

STANDARDS OF ACCURACY

✓GAUGING







LARGE staff of highly trained technical men — constantly checking, testing, and gauging every stage of construction and assembly — ke sure that every part — every unit — meas-s up to Milwaukee standards of milling ma-ne quality and accuracy.

ARNEY & TRECKER CORPORATION
MILWAUKEE, WISCONSIN

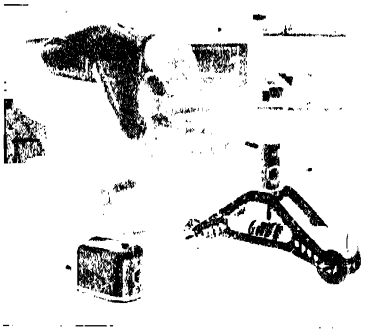


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Milwaukee MILLING MACHINES

Blackhawk Mfg. Co., 5025 W. Rogers St., Milwaukee, Wis.

Known as the Model P-95 "Porto-Power" pump, this unit weighs only 32 lb. and is powered with a built-in ½-hp. motor. It can be connected with high-pressure hose to any one



of the Blackhawk rams, which are otherwise used with hand-operated pumps. Pump can also be equipped with a gage for testing or weighing in tons total load or pounds per square inch pressure.

Cellulose Sweat Bands Have Cork Inner Linings

Two ruggedly constructed sweat bands, made of fine-pore cellulose sponge securely stitched to a fabricoid band with an inner lining of cork, have been announced by Jackson Electrode Holder Co., 6553 Woodward Ave., Detroit, Mich. The No. 15, illustrated, is a general purpose band for eliminating the hazard of perspiration running into the eyes.



It is easily adjusted to the head with a long lasting ½-in. elastic band. The No. 5 band is intended for use with all Jackson eyeshields except the Types D, D-6 and No. 25. It is snapped inside the shields. Both bands are light, cool and comfortable, and easily absorb more than fifteen times their own weight in moisture. They are quickly cleaned by letting water or any safe antiseptic solution run through the sponge.

Baldor Deluxe Grinder Has Light in Eyeshield

The outstanding feature of the deluxe grinder offered by Baldor Electric Co., 4351 Duncan Ave., St. Louis, Mo., is the shatter-proof glass eyeshields which accommodate a tubular light, which throws light on either side of and in front of the wheel without creating annoying shadows. Identified is the No. 724 grinder, this 7-in. model is powered with a ½-hp., 3400-r.p.m. motor, and is equipped with 7x1-in. "Aloxide" wheels.

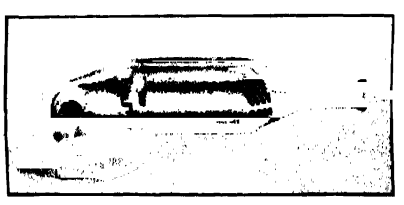


Other features of this machine include spark breakers, a water pot attached to the grinder, and a tool rest which is adjustable to and from the wheel, up and down, and which may be tilted for angle grinding.

Three More Disk Sanders Made Available by Skilsaw

Skilsaw, Inc., 5033 Elston Ave., Chicago, Ill., has developed three additions to its line of disk sanders.

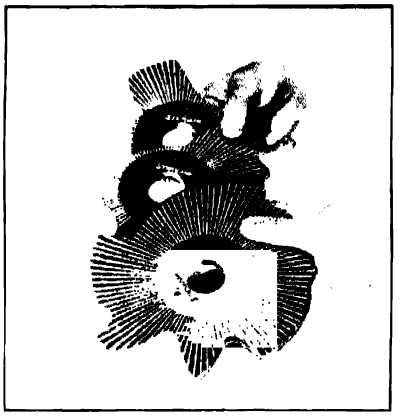
Model SP is a two-speed heavy duty sander and polisher especially developed for steady use in metal fabricating plants where there is a variety of sanding, polishing and buffing operations. When operating at 4,200 r.p.m. with a 6-in. disk, is provides a maximum of sanding efficiency. When changed to 1,300 r.p.m., the tool is suitable for use with felt rubbing pads or lamb's wool polishing bonnets for rubbing down lacquered surfaces and for other polishing operations. A simple gear shift makes it easy to change from one speed to the other. Eight heavy duty ball bearings mounted on all shafts make possible carrying maximum loads and insure quiet operation and long life.



Model SP is 18½ in. long and weighs 14¾ lb.

Model H2, illustrated, is a two-speed heavy duty sander for use wherever sanding work is constant in nature. A 9-in. disk is first used at a speed of 2,700 r.p.m., then, when the outer edge of the disk becomes worn, it is re-sized to 7 in., using a special trimmer provided. It is then mounted on the alternate 7-in. pad and is used at 4,200 r.p.m. Eight heavy duty ball bearings mounted on all shafts give this tool greater efficiency and longer life. Model H2 is 19½ in. long and weighs 16 lb.

Model SL is an extra heavy power unit that can handle a wide variety of heavy duty sanding, grinding and surfacing operations. It operates at a no-load speed of 5,000 r.p.m., the speed recommended by grinding wheel manufacturers as the most practical for 6-in. wheels to insure fastest production and longest life. Model SL may be used with various sanding pads, grinding wheels, wire cup brushes and other accessories. It is 18 in. long and weighs 15 lb.



Screw Machine Cam Blanks Permit Less Cutting Time

Synthane Corp., Oaks, Pa., has introduced a series of cam blanks for Brown & Sharpe automatic screw machines which are claimed to make possible the production of a complete set of cams for these machines in much less time than formerly required. Only a small wood cutting bandsaw, a disk sander and filer are required.

Synthane cam blanks are furnished in sets of three for sizes 00, 0 and 2 B&S machines. All blanks have center hole bored, pin hole drilled, and radial lines scribed for ease of layout.

These blanks are said to be suitable for all but the heaviest feeds, and to be ideal for short runs because they are easily and quickly cut. They are also claimed to produce excellent results on long runs, with runs of over 4,500,000 pieces having been made.

"Universal" Electric Etcher Features Streamlined Design

Everything safely enclosed and out of the way is the outstanding feature of the No. 13 "Universal" portable electric etcher announced by Ideal Commutator Dresser Co., 1057 Park Ave., Sycamore, Ill. Etcher tool and

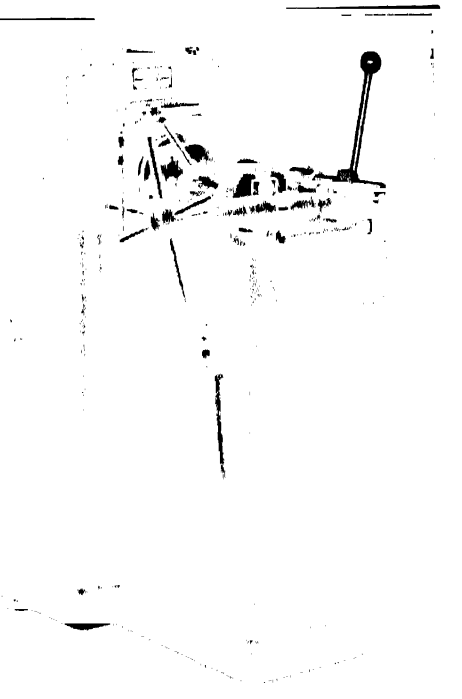
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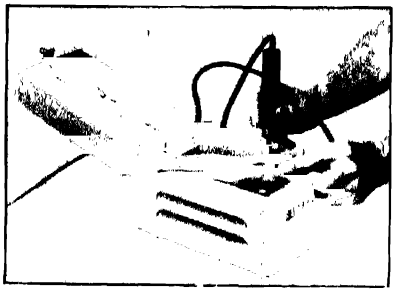
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cords, switch and indicator lamp are all under cover. Small objects are etched on the work plate which forms part of the case, while a ground clamp is furnished for larger objects. The cover is removable if desired.

Etching heats are 120, 240, 420 and

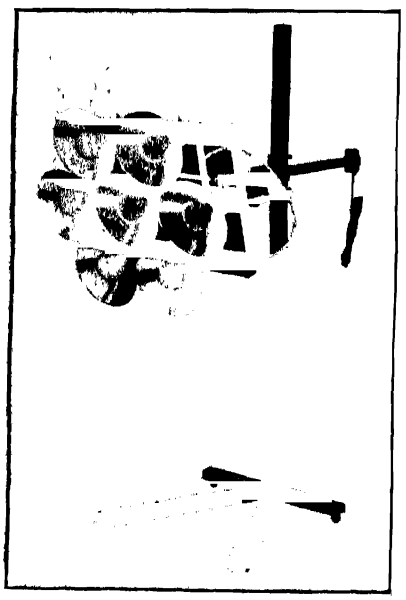


700 watts. A red indicator lamp burns brighter as the higher heats are turned on. Plenty of power is provided for permanently marking tools, parts, dies, bearings, saws, drills and other metal objects. Writing is as easy as with a pencil, leaving the mark clearly and permanently burned into the metal The standard unit is 110 volts, 60 cycles, a.c. power Over-all size is 7¼x5⅛x 8½ in. Weight complete is 16 lb.

Infra-Red Baking Units Offered in Portable Models

Fostoria Pressed Steel Corp., Fostoria, Ohio, brings the advantages of infra-red baking and drying to small lot work with the introduction of the Model P-7-IR portable fixture. Equipped with seven pure gold plated reflectors, this unit is universally adjustable to permit its use in many types of applications.

This flexible infra-red bank has been especially designed for use on paint and enamel repair jobs. It handles areas up to approximately



30 in. in diameter and can be adjusted to any position desired, and to a height of from 18 to 72 in. The ruggedly constructed portable stand is mounted on easy-rolling casters.

"Thor" Portable Air Grinder Features Positive Starting

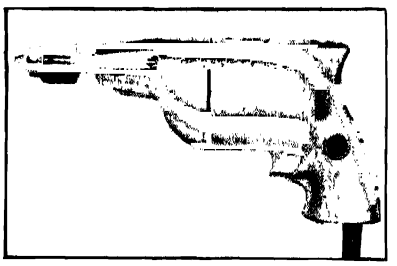
Based on a new "air behind the blades" principle, the No. 255 "Thor" portable air grinder offered by Independent Pneumatic Tool Co., 610 W. Jackson Blvd., Chicago, Ill., assures positive starting under all operating



conditions. Air behind the blades keeps rotor blades out against the cylinder wall, preventing any dead center position or the depression of the blades in the slots due to oil accumulation.

Black & Decker "Tapgun" Weighs Only 3 3-4 Lb.

Black & Decker Mfg. Co, Towson, Md., has introduced a new tapper



to its line of one-hand, high-speed production tools. Known as the "Tapgun," this unit weighs only 3¾ lb. and measures 9¼ in. over-all. It taps up to 5/16 in. in cast iron, 3/16 in. in steel, and ⅜ in. in brass or aluminum. Machine taps at 400 r.p.m., and backs out at 525 r.p.m.

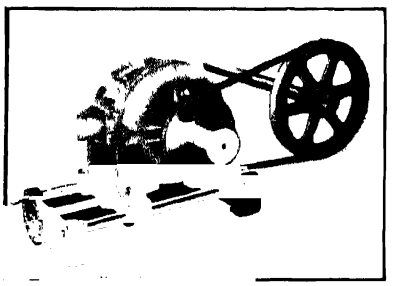
"Vari-Speed Jr." Transmission Designed for Small Mechanisms

Reeves Pulley Co., Columbus, Ind., has developed a variable speed transmission which brings the advantages of variable speed control to even the smallest and lightest machinery. Known as the "Vari-Speed Jr.," this unit can be used with any constant-speed motor up to 1½ hp. Speed is completely adjustable, and no special shaft extension is required.

Unit comprises a disk assembly and adjustable motor base. Disk assembly consists of two cone-shaped disks, one stationary and one laterally adjustable, a self-adjusting tension spring, and a spring adjusting nut and cover. This assembly is applied directly to the standard shaft extension of the motor, which is mounted on an adjustable base. A standard V-belt is used.

An adjusting handwheel moves the motor forward and back. When nearest to the driven sheave, the V-belt runs over the largest diameter on the disks and maximum speed is secured. Reversing the handwheel moves the motor away from the driven sheave, the belt runs over the smaller diameter, and the speed is reduced.

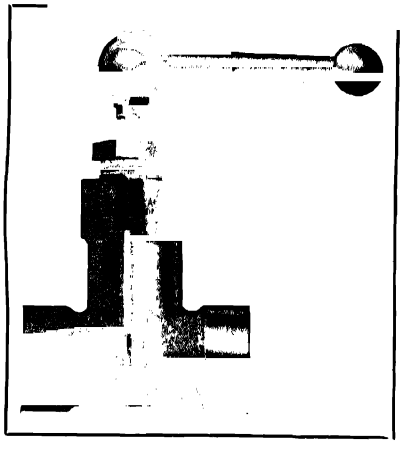
The device is built in six different sizes for use with motors of ⅛ to 1½ hp. Speed control over a range of from 1¼:1 to 2¼:1 is provided, de-



pending on the size, power and speed of the unit selected. Two sizes of motor base are available The unit is also built in a countershaft type for unusual speed reduction or speed increase.

Blackhawk Needle Valve Stands 10,000 lb. Pressure

A special high-pressure needle valve, made necessary by the growing list of applications for hydraulic equipment, has been produced by the Blackhawk Mfg. Co., 5025 W. Rogers St., Milwaukee, Wis., to withstand pressures up to 10,000 lb. per sq.in. This valve, known as the "V-8," is readily applicable to hydraulic controls of machine tools and other types of equipment. It can be used



with any fluid not injurious to leather, bronze or stainless steel.

In addition to its high-pressure capacity, the new valve is compact and reasonably priced. It is made with standard ¾-in. pipe taps.

NEW MATERIALS

"Bermax" Bearing Metal Has Many Applications

Continuous research and development since 1930, when lead-base babbitts were considered unfit for use in internal combustion engine main and connecting rod bearings, has resulted in "Bermax" alloy, offered by Federal Mogul Corp., Shoemaker & Lillibridge Sts., Detroit, Mich. Said to offer unusual properties and advantages, this alloy is exceptionally well suited to a wide range of applications in the automotive and other industries. It is claimed to offer substantial savings in a majority of applications for which it is suited, to produce greater efficiency in many applications, to overcome the corrosion problem encountered in many uses, and to be easy to use, easy to cast, and easy to handle in rebabbitting.

"Bermax" is so positioned in the lead-tin-antimony ternary system that an excellent compromise of desirable properties is effected. Its melting point is slightly higher than that of the tin-base metals, and it can be cast by any method without fear of segregation. It is not brittle, and it is not subject to oil corrosion.

TRADE PUBLICATIONS

AERO-THREAD SCREWS Bulletin No. T-1, circulated by Aircraft Screw Products Co., Inc., 25-12 41st Ave., Long Island City, N. Y., offers information on Aero-Thread screws which are used where maximum strength is required.

ASTM STANDARDS American Society for Testing Materials, 260 S. Broad St., Philadelphia, Pa., offers a 152-page index to ASTM Standards.

BEARINGS A 4-page folder No. A-40 circulated by Chrysler Corp., Detroit, Mich., offers a listing of sizes and prices of Oilite bearings.

BEARINGS Catalog No. 35X issued by the Fafnir Bearing Co., New Britain, Conn., gives full data on dimensions, load ratings, types and sizes of Fafnir bearings.

BERYLLIUM ALLOYS Engineering Data Sheet No. 25, circulated by Beryllium Corp. of Pennsylvania, Reading, Pa., comments on physical properties, heat-treating data and other information of Berylco, a beryllium copper alloy.

CAM GRINDERS Ohio Units Manufacturers, Dayton, Ohio, illustrate the construction and operation of cam grinding equipment in a new 12-page booklet.

DIE CASTING The New Jersey Zinc Co., 160 Front St., New York, N. Y., has issued a 37-page booklet which gives information on designing for zinc alloy die casting.

DIESELS Chicago Pneumatic Tool Co., Chicago Pneumatic Bldg., Chicago, Ill., is circulating bulletin No. 768 which describes the reliability and economy of operation of diesel engines.

ENGINEERING FOUNDATION A 76-page booklet circulated by the Engineering Foundation, 29 W. 39th St., New York, N. Y. recounts its 25 years of service.

FORGINGS An 8-page folder circulated by Drop Forging Association, 605 Hanna Bldg., Cleveland, Ohio, illustrates and discusses the advantages of drop forgings.

GRINDING Printed in six colors, Bulletin No. G-455 published by Cincinnati Grinders, Inc., Cincinnati, Ohio, illustrates and describes the principal features of the new Cincinnati hydraulic universal grinding machine.

LAMPS A four-page illustrated booklet No. F-8500, offered by Dept. 7-N-24, Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., describes rim fluorescent lamps which are designed for general or supplementary lighting in low bay industrial areas.

LEWIS IRON Joseph T. Ryerson & Son, Inc., 16th and Rockwell Sts., Chicago, Ill., has issued a 4-page pamphlet describing the application, physical properties, and sizes available of Lewis engine bolt iron.

METAL THICKNESS A four-page folder circulated by E. I. duPont de Nemours & Co., Inc., Wilmington, Del., discusses a test for determining local thickness of electrodeposited zinc, cadmium, tin and copper.

MOTORS Four-page pamphlet No. GEA-3307, issued by General Electric Co., Schenectady, N. Y., illustrates the construction and operating features of self-starting inductor motors.

SPRAY EQUIPMENT A 22-page catalog No. 77, issued by Eclipse Air Brush Co., Inc., 298 Park Ave., Newark, N. J., illustrates a complete line of spray equipment for both manual and automatic operation.

SAFETY EQUIPMENT Price List No. 4, for Safety Catalog No. 40,

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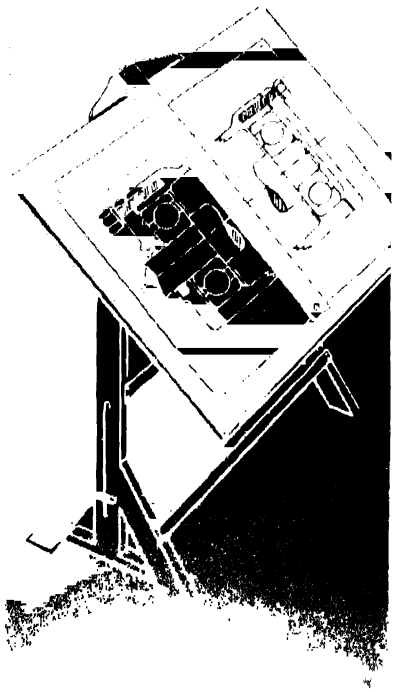
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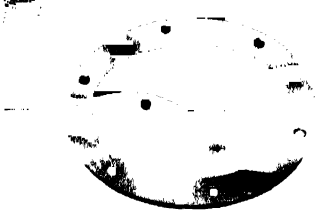
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which describes industrial safety equipment is being circulated by the Boyer-Campbell Co , 6540 Antoine, Detroit, Mich

WELDING Information Circular No I C 7121, entitled "Minerals Used in Welding" published by Bureau of Mines, United States Department of the Interior is devoted to a discussion of welding-rod coatings and fluxes employed in the welding of common metals

NEW BOOKS

MOTION AND TIME STUDY—*Second Edition By Ralph M Barnes professor of industrial engineering and director of personnel College of Engineering University of Iowa 382 pages Published by John Wiley & Sons, Inc , New York, N Y $3 75*

In this second edition of his well accepted volume the author has extended its usefulness by enlarging certain features and by adding illustrative material Case studies have been added to the material on process charts, operation analysis and visual direction to show widely diverse applications Summarized results of research studies conducted in industrial engineering laboratories at the University of Iowa have been incorporated in the text During the past three years more than a million measurements of hand motions used in factory operations have been made in this laboratory

Present-day requirements for the attainment of maximum production efficiency with available equipment with the continued interest in fatigue reduction naturally has led to a widening of the interest of management in time and motion study methods Today as never before management must determine quickly the most economical method and the amount of work that should be done within a given period of time This new edition of Mr Barnes book on time and motion study methods contains many suggestions that should be of value to production supervisors and industrial engineers in the metal-working as well as other industries

•

THE STORY OF SUPERFINISH — *By Arthur M Swigert Jr director of production research, Chrysler Division Chrysler Corporation 672 pages Published by the Lynn Publishing Co 5106 Buckingham, Detroit, Mich $5*

Probably no new process of metal finishing has aroused so much comment in recent years as the Superfinishing process introduced by the Chrysler Corporation largely through the efforts of David A Wallace president the Chrysler Division Its proponents have claimed remarkable results from its use while its detractors see in it only an extension of the familiar honing procedure Whether the process be called Superfinish or by any other name it has certainly accomplished two things the extension of fine finish to parts which formerly were left in a rougher state, and accelerated research into methods and materials for achieving quality surfaces

Mr Swigert's volume explains step by step just how the process came into being what it does how it is applied and the advantages gained by its use Wherever possible the points made are clarified by means of illustrations which appear profusely throughout the volume

Readers of *American Machinist* have had the opportunity of seeing many articles on Superfinish including the first to be published on this subject It is therefore probably unnecessary to state that the Superfinish process removes the amorphous metal left by other means of tooling, using light working pressures and a multiplicity of motions An important feature of the process is the use of suitable grades of lubricant in order to halt the cutting action when the parent metal is reached

Those who may have become confused by the many pros and cons surrounding this method of metal finishing will have in this volume a means for leisurely perusal of just how it is being used and what is claimed for it

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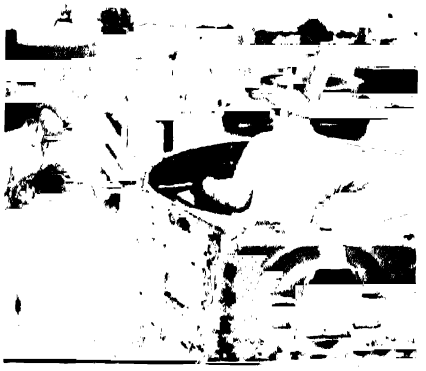
LESSONS IN ARC WELDING *Prepared and published by the Lincoln Electric Co 12818 Coit Road Cleveland Ohio 136 pages $0 50*

Based principally on experience of Arthur Madson this book form the basis of instruction in the Lincoln Arc Welding School It is the object of these lessons to present concisely certain fundamentals of welding which the operator should know in order to successfully and economically use the welding process The text material is divided into 52 individual lessons each of which presents the study of an individual welding problem and presents the proper procedure

While these lessons deal especially with the use of Lincoln welding equipment and Lincoln electrodes since the book appears to have been prepared especially for use in connection with the Lincoln Arc Welding School the principles discussed and the procedures given are applicable wherever arc welding is used no matter what equipment is available Much data on proper welding procedures is tabulated for ready reference In the back of the book are given a series of questions dealing with each of the individual lessons previously discussed, answers to these questions also are tabulated in another section

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Coming October 16

THE ANNUAL METAL SHOW NUMBER

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featuring

★ *The Show in Print*—A picture-by-picture description of new equipment at the Show—and *in advance*, to help you plan your visits if you're going, to provide a preview if you're not, and for your record, in either case. Letters of inquiry have already gone to all exhibitors, finding out what will be *new* at the Show. American Machinist will preview the Show for *you* five days early.

★ *The Working of Flat-Rolled Carbon Steel Sheet*—Ninth of the American Machinist series of special sections on The Working of Materials. This one summarizes latest practice in forming, shearing, blanking, welding, heat-treating, machining and finishing. As condensed and authoritative as earlier sections—of which over 40,000 reprints have been purchased.

★ *Heat-Treating Processes in Munitions Manufacture*—A detailed review of new and generally applicable heat-treating methods and procedures, obtained by close survey by our editors.

★ *Welding Processes in Munitions Manufacture*—An exhaustive presentation of modern welding and cutting techniques as applied in shops and shipyards all over the country.

★ *Advertising Pages Keyed to the Show*—Advertising describing what's new in metal-working equipment, accessories, tools and supplies, and what it can do for you.

WATCH FOR YOUR COPY OF THIS SPECIAL 5-STAR FEATURE NUMBER

WHAT'S IN THIS ISSUE

MANY TANKS

During the present war so much emphasis has been placed on planes that we're inclined to overlook other elements of a mechanized military force As information begins to trickle out of France we are forced more and more to the conclusion that Hitler's astonishing advance owed much of its success to skillful coordination of all mechanized units And so, while we should not slacken efforts to boost plane output, we should also exert great efforts to produce *balanced* mechanized forces Prominent in such forces are tanks

Like other machines of war, tanks have their own production difficulties Armor plate, for instance, by its very nature presents many tough fabrication problems And to a host of other manufacturing difficulties are often added those caused by frequent design changes Even for Rock Island Arsenal, turning out tough tanks is hardly child's play

So that American industry can familiarize itself with the problems of tank manufacture, this issue's Armament Section is devoted to the Rock Island production methods as applied to the M 2 medium tank On page 709 Uncle Sam takes you on a tour through the arsenal, so that when, as and if you find yourself with a tank contract, you'll be better prepared to get into production



R. RANDALL IRWIN
still needs more men

WHAT—NO GRAVY?

A tremendous amount of misunderstanding has arisen from the aircraft industry's pleas for workers One friend of ours fresh from college, became furious at being offered no more than the typical beginner's wage A garage mechanic of our acquaintance was positive he could drag down $100 a week in Paterson or Hartford, and only fruitless interviews convinced him he should keep on tinkering with cars And now and then we get a hot letter from some unemployed old timer damning us for saying that the aircraft companies need men To all these and others too we recommend the article beginning on page 695, which repeats that the aircraft industry *does* need men, and needs them badly But not just any kind of men In it R Randall Irwin, Lockheed's industrial relations manager, explains his company's particular personnel problems and what's been done to meet them It should be an eye opener to all job seekers hungering to lap up some aircraft gravy

TRICKY FIXTURES

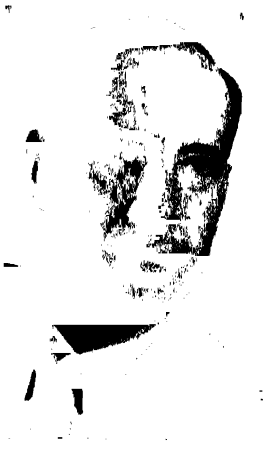
With increasing attention being paid to squeezing the utmost production from existing equipment, further emphasis is being laid on fixtures On page 697 is discussed a rather unusual phase of fixture usage It deals with induction hardening of small parts a process usually requiring special machines to be built for each part to be treated But with a basic machine, *and* proper fixtures, many small parts, in small lots can now have the benefits of induction hardening Frank W Curtis, of Van Norman Machine Tool, gives the details

SERIAL

Part four of C C Street's series on measurement for production, which you'll find on page 700, also deals with fixtures This installment outlines ways to use dial gages for inspection and production, when built into specially designed fixtures Fundamental design principles are given, with specific examples making various points clear Their proper application can often result in more accurate fixtures involving less time, trouble and expense Which ought to prove helpful in turning that tough inspection job into a considerably easier one

NO EXCUSE

Though everyone seems to be well aware that accidents do not merely happen, few persons ever get right down to the basic causes To our mind one of those few is Edward Kann, who for fifteen years was in charge of the parts production department of Philips Radio Company Eindhoven, Holland A frequent visitor to the United States, Mr Kann



EDWARD KANN
left in a hurry

had just sailed from Holland when the Nazi invasion took place With him was a bang up article on how Philips had completely eliminated power press accidents You'll find it on page 702, illustrated with photographs enlarged from 16 mm movie film, the only pictures available in Mr Kann's hurried departure

COMING

The third AMERICAN MACHINIST Armament Section will be devoted to the manufacture of cartridge cases This will be another of those "this is how *you* can do it" articles which, we fervently hope, will prove of value in speeding the defense program Like this issue's section on tanks, it will be detailed, exhaustive and authoritative

Also scheduled for an early number is a discussion of infra red baking principles This is a jammed with data type of article you won't want to miss Look for it soon in AMERICAN MACHINIST

MAKING BETTER MACHINE TOOLS
with better machine tools



Cincinnati Hypro Planer handling highly productive work for a well known machine tool builder.

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Cincinnati Hypro Planer Miller performing another operation on machine tool bed.



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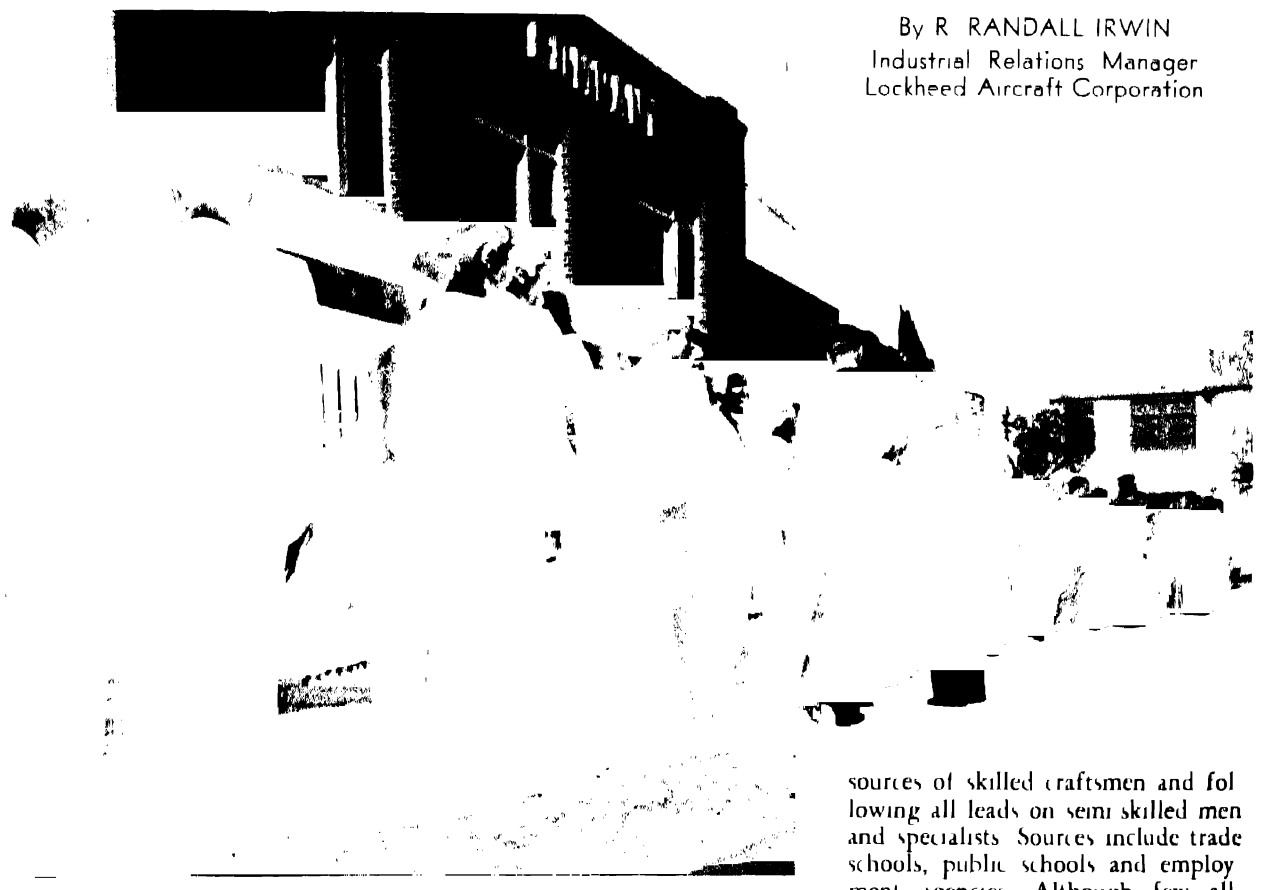
A COMPLETE LINE OF PLANERS *and* BORING MILLS . . .

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THE CINCINNATI PLANER CO.

Wanted: Skilled Men

By R. RANDALL IRWIN
Industrial Relations Manager
Lockheed Aircraft Corporation



The aircraft industry is crying for skilled men so lines like this form outside plane plants. But less than one quarter of these applicants, on the average, have any experience. Lockheed men go down this line every morning, forming a separate line of the few claiming craftsmanship. They might land jobs in the toolroom. Some of the rest may be eligible for semi-skilled production jobs after a few weeks of training.

ABOUT 80 PER CENT of aircraft workers fall within the semi-skilled classification. Such men as riveters and sheet-metal workers can be trained in a relatively short time, generally from three to six weeks. But the other 20 per cent must be skilled, experienced, all-round men. During the expansion period a major part of aircraft work is devoted to tooling. For such work men most needed are versatile machinists of the job shop type, tool and die makers, and others highly skilled.

We at Lockheed have attacked the problem on three fronts. (1) We are making an energetic and scientific effort to obtain all skilled machine men who may still be available. (2) We are finding ways to make the best of such men. (3) We are conducting a vigorous long-term training program to provide properly trained men for the future.

First line of attack is to search out all available talent. We start by keeping in close touch with all known sources of skilled craftsmen and following all leads on semi-skilled men and specialists. Sources include trade schools, public schools and employment agencies. Although few all-round craftsmen are available from such sources, we receive many specialists by cards of introduction and such men are immediately interviewed, tested, and hired if found qualified to perform some phase of our work. About half of our new workers in the craft lines come to us in this way, and the other half are sifted out of the applicants for employment who daily besiege our front gate.

To streamline the obtaining of qualified craftsmen we follow a careful plan of selection off the employment line. Normally several hundred men are lined up outside the employment office at the day's start. We first go down the line and form a new line of men claiming to be skilled workers. During the first hour we usually separate about 25 per

cent of the applicants in this way. Engineers and draftsmen are employed through a separate procedure which takes them direct to the engineering section of the employment division.

From our line we pick tool and die makers, machinists, welders, auto mechanics, power hammer operators, jig and fixture builders, plumbers, millwrights, precision assemblymen, and various other skilled workers. Each day we are supplied with the personnel requirements of the various departments. These are listed in convenient form and supplied to the interviewers. Such lists show the interviewer what department is requisitioning labor, what classification of worker is required and what quanti-

After we have done our best on the hiring line to obtain men for machine work and other skilled occupations, there is still the problem of keeping production going in cases where the employment division has not been able to provide sufficient skilled men. This is a real problem, especially in such departments as tool making, as there is no satisfactory substitute for skilled tool makers. Also, as the factory expands we find that an increasing number of craftsmen must be promoted to supervisory jobs. However, we use the capabilities of the supervisory personnel to the limit in encouraging development of men whose skill may be in the lower brackets. We maintain a special school for supervisors to help them



Cynical indeed become rusty old-timers, mediocre garage mechanics and high-school kids when they find they can't get high-paid jobs in the aircraft industry. It's men like this, capable of getting the utmost out of precision tool-room machines, who are received with open arms

ties of such workers are needed. Armed with this information, interviewers work the line of skilled applicants to select those most likely to fill our requirements. A carefully developed set of test questions, plus knowledge of trade requirements on the part of the various interviewers, helps these men eliminate bluffers.

Selected men are passed on to the personnel testing section for temperament, dexterity, aptitude and trade knowledge tests. These tests have been developed by experts and quickly catch anyone who may have bluffed his way past the preliminary interview.

A final interview is then given to all men who have come through the selection process successfully. This interview determines such matters as assignment to a specific department, agreement as to wage rate, informing of the applicant as to work, etc.

speed up this advancement process. Ordinary machinists are encouraged to learn tool and die work. Machine operators or those who are rusty from lack of employment are encouraged to broaden their skill and so progress to more exacting work. Wherever possible, skilled all-round men are diluted with less skilled men. In this way the whole body of skilled workers moves steadily toward higher ratings, making it possible to feed less skilled men into the shop lower down the line.

As to the long-term program, Lockheed has, with the help of the Federal Committee on Apprenticeship, the California State Bureau of Trade & Industrial Education, Burbank Unified Schools System, California Apprenticeship Council, and employee representatives, developed a vigorous apprentice training program directed toward employment of men between the ages of 18 and 23 years.

Another phase of the training program is handled as a mass problem. Under a public school trade extension program some 53 different night classes devoted largely to shop work are attended by about 50 per cent of the Lockheed day shift employees. From classes and outside applicants, apprentice candidates are selected. The apprenticeship covers a period of four years, and the agreement requires a minimum of 144 hours a year to be spent in school during the term of the indenture. Subjects taught include trade mathematics, shop drafting, blue-print reading, materials and processes, etc. The work week consists of 36 hours in the factory and 4 hours of classroom instruction, for which the apprentice receives full wages at his regular rate. The first class under this plan was inaugurated last February and the apprentice program has since been materially expanded. The plan calls for training one apprentice to every ten journeymen.

In this program the man is thoroughly trained not only as a specialist but in all phases of his trade. This assures his future employment as well as making him an accomplished aeronautical craftsman. Apprenticeship training is divided into eight classifications as follows: Aircraft machinist, aircraft tool and jig builder, aircraft wood pattern and wood jig builder, aircraft sheet metal, aircraft electrical trade, aircraft welder and metal fitter, aircraft painting and processing, and aircraft upholsterer and trimmer. Scope of the training may be judged by suggested hours of work experience for the aircraft machinist apprentice: hand bench, 300; drill press, 500; turret lathe, 500; engine lathe, 1,800; milling machine, 1,000; planer, 300; shaper, 500; turret lathe job setter, 500; precision grinding, 200; tool grinding, 700; bench machinist, 1,000; inspection, 200; office, tabulating, operation sheets, office system, etc., 320; and additional work on above operations as required, 500. This totals 8,320 hours. Each apprentice undergoes this minimum amount of training, with the work varied to meet his particular capabilities.

By these methods Lockheed Aircraft Corporation is doing all in its power to meet the need for the vital 20 per cent of trained men in the aircraft industry if production is to be expanded as required. So far we have been able to meet every demand successfully. And we believe our program is equal to any task that may be imposed in the future.

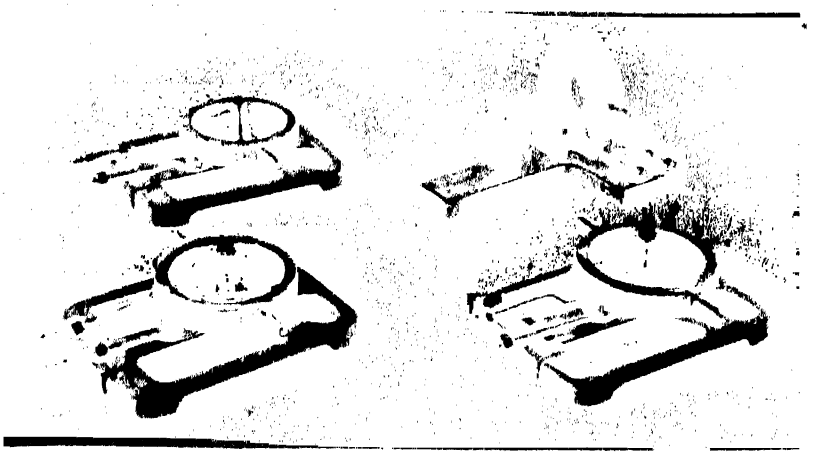
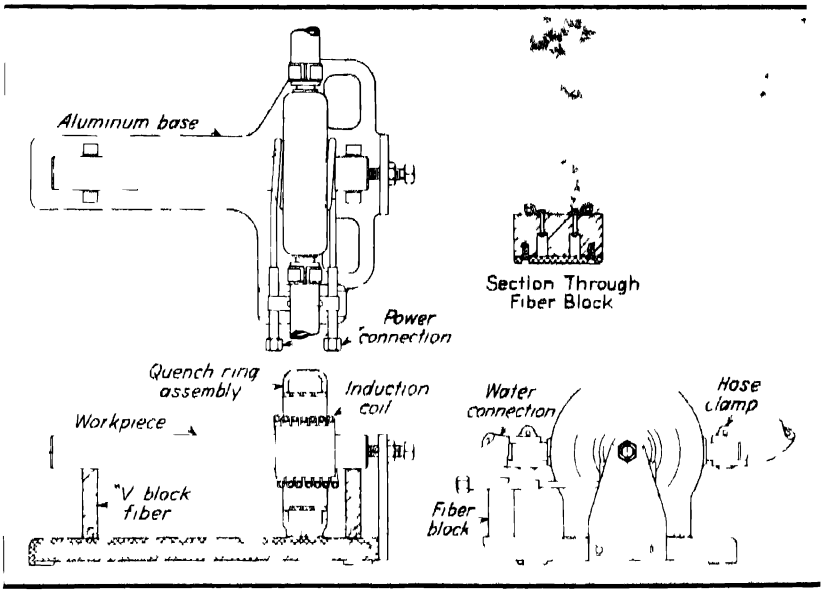


Fig 1—A fixture is made up from standard parts for each production item to be hardened Here are shown three vertical-type and one horizontal fixture, each arranged for hardening a single surface on some specific part

Holding for hardening

Fig 2—Made for hardening a cylindrical surface near one end of a long shaft this horizontal type induction hardening fixture requires only two electrical connections and two water tube connections to the Tocco hardening machine A stock of standard aluminum bases quench rings and quench ring tubes is kept on hand in the hardening room so that the operator of the machine can build up fixtures for any new parts coming through



BY FRANK W CURTS MILLING MACHINE DIVISION VAN NORMAN MACHINE TOOL COMPANY

Use of suitable fixtures makes induction hardening applicable to a wide range of small parts

HIGH FREQUENCY induction hardening has been applied successfully for several years on such parts as automobile crankshafts and camshafts made in large quantities Until recently this process has not been available for small lot runs on a large variety of parts It has been through the application of specially designed interchangeable fixtures that we have been able to use the Tocco method to advantage with small quantity lots

The design of these fixtures is such that only two base castings are required one for horizontal fixtures and the other for vertical fixtures These base castings are made of aluminum alloy so that the fixtures can be handled easily, reducing set up time to a minimum Several standard sizes of bronze quench rings are made up and kept in stock so that fixtures can be assembled for new parts by the operator of the hardening machine

As shown in Fig 1 and outlined in Fig 2, these fixtures consist essentially of the base casting on which is mounted the quench ring assembly the copper tube induction coil, fiber connection blocks and brass centering plugs In Fig 1 are shown three vertical type fixtures and one of horizontal design The brass centering plugs are shown in position in the vertical units

In placing the fixture on the machine it is necessary only to make two connections to the copper induction coil and two hose connections for



Fig. 3—Once the fixture has been mounted on the machine, it is necessary only for the operator to place the part in the fixture, press a starting button and the machine goes through its heating and quenching cycle automatically. Cycles are determined by metallurgical observation of the first piece

quenching water. Fixtures have been interchanged in less than two minutes by our present operator

Copper tube induction coils are wound to suit the parts to be hardened. Annealed tubing is used and is wound on forms so that it will be of a size to allow approximately $\frac{1}{8}$ in clearance between the coil and the work. Where flat faces are to be hardened on the end of parts, the coil is wound in the form of a spiral, for hardening cylindrical pieces on the outside diameter the coil is a helix slightly larger in diameter than the part. For beveled gears and other conical parts, the coil is made in the form of a cone. When the necessary coil has been wound, it is tied with asbestos thread and dipped in varnish so that it will hold its shape

Holes in the quench ring assembly are drilled with a No. 50 drill and are spaced approximately $\frac{1}{4}$ in. apart. Several rows of holes are provided around the quench ring so that the quenching water will cover the heated section of the part quickly. A water pressure of about 60 to 70 lb. per sq. in. is used.

A number of advantages have been obtained by using high frequency induction hardening in place of the case-hardening procedure formerly employed. Previous practice was to use low carbon steel, similar to S.A.E. 2315 or X-1315, with carburizing and hardening operations requiring several hours with two separate heatings of the entire part. This resulted in scale and a certain amount of deformation, with grinding and straightening operations necessary after hardening had been completed Another saving obtained by using induction hardening is that under the previous method it was necessary to have a man come in on Sunday night to start up the furnaces; this now has been eliminated

Present practice is to use higher carbon steels, like S.A.E. 2340, 2350, X-1340 or 1050 The 0.40 carbon steels now give a hardness of 55 to 57 Rockwell, while the 0.50 carbon steels are used for higher hardnesses of 60 to 62 Rockwell C In some cases, with small parts requiring extreme hardness, we have used S.A.E. 52100 steel and have obtained a hardness of 67 68 Rockwell C The hardened case obtained is uniform and selective Only certain surfaces need be hardened, depth of case is controlled by the length of the heat cycle and little straightening or grinding after hardening is necessary

Once the proper heating and



Fig. 4—Once the heating cycle has been completed, water under 70 lb. per sq. in. pressure is admitted through the water tube to the quench ring assembly of the fixture and thence is directed through the induction coil against the heated surfaces of the parts. Both time of delay between heating and quenching cycles and length of quenching cycle are controlled automatically by the machine. Once the fixture for a given part has been made, lots as small as six can be economically hardened by this method

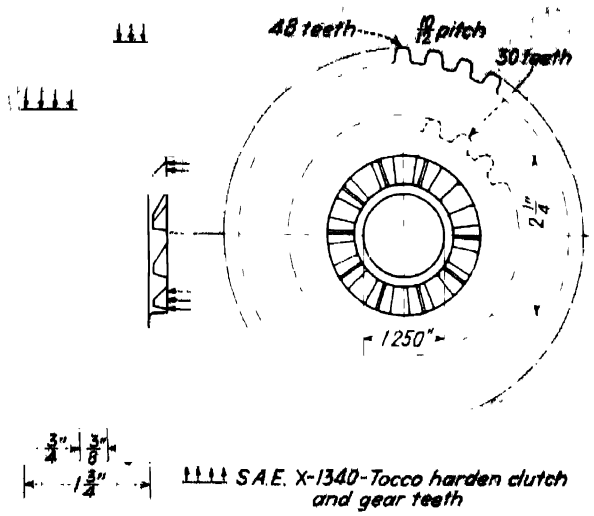
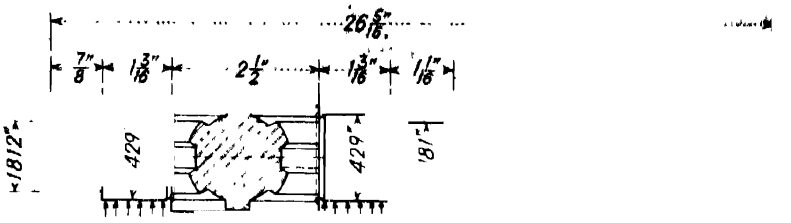


Fig. 5—This combination clutch and gear made from S.A.E. X-1340 steel is induction hardened on three surfaces, using three individual fixtures and hardening one surface at a time. Arrows on the drawing indicate the surfaces to be hardened

Fig. 6—Two bearing surfaces on this 26 in. long shaft made from S.A.E. 2350 steel are induction hardened in a horizontal-type fixture without distortion of the shaft, and without disturbing the hardness of other sections of the shaft. Arrows indicate surfaces hardened

quenching cycles have been determined, uniform results are obtained. We usually set the machine for a 1/16-in. case on the section of the part to be hardened. The first piece is timed only for bringing it to heat and the time for quenching is estimated. The correct cycle is then recorded and when another piece of the same design is brought to the hardening room the operator consults his record book and adjusts the machine accordingly. The cycle of the machine includes: heating time, delay between heat and quench—seldom necessary, and quenching time. Hardness obtained can be reduced by delaying the quench after the part has been heated.

Because of the inherent reaction of steel as its temperature rises, the heating effect decreases as the critical point of the steel is approached. On this account, the surface being treated cannot be overheated and continued application of power only causes the heat to be generated farther in toward the center of the part.



Job lots as small as from one to six pieces can be hardened economically with this set-up, once the necessary fixture has been made. As many surfaces on the part as necessary may be hardened by providing the necessary fixture for each surface.

Pieces requiring hardening on only one surface usually take about 20 sec. floor to floor time. A clutch part which is hardened on the two faces, as shown in Fig. 4, has been timed at 0.7 min. floor to floor, including the hardening of both surfaces in the same fixture.

In Figs. 5 and 6 are shown two typical parts now being successfully induction hardened without distortion and without additional machining being necessary after the hardening operation. These parts are shown in order to explain the method used to indicate surfaces to be induction hardened. A group of arrows pointing to the surface of the parts indicates the section to be hardened.

Welder Tones Down Locomotive Whistle

By ARTHUR HAVENS

IT IS ODD sometimes just what will bring about a change in locomotives or their appurtenances. In a small city in southern Vermont there is a bad crossing, and it is customary for engineers approaching it to blow their whistles long and loud. The whistles on this road are of the five-step variety having an extremely shrill tone when wide open. This whistling bothered the natives to a point where they made a formal complaint to the railroad management, which didn't want to spend money for new whistles.

A welder figured that if the high step or perhaps the two high steps were cut out or made deeper it would tone the whistle down somewhat. He melted the top from the two high steps, and brazed in pieces of 1/8-in. plate, continuing the ribs of the whistle to the top. He covered these ribs with pieces of plate bent to the same radius as the body of the whistle, making the originally sharp toned compartments similar to the low-toned parts. This converted the whistle from a five-tone to a three-tone. Since the casting proper is brass the steel plate had to be bronzed to the casting.

This whistle was found to be satisfactory in every respect, being loud enough but not nearly as ear-splitting as before.

METHODS OF MEASUREMENT—No. 4

Fixtures for production

BY C C STREET, CHIEF ENGINEER FEDERAL PRODUCTS CORPORATION

Properly placed dial indicators afford a convenient method of comparing work dimensions to those of an accurate master

THE DIAL INDICATOR finds a wide field of application where production is on a sufficiently large scale to warrant the construction of special inspection fixtures Elaborateness and cost of these fixtures depend both on the degree of precision desired and on the complexity of the measuring problem The art of designing these special purpose gaging fixtures is sufficiently broad to justify its consideration as a specialized type of engineering

One of the primary requisites for a proper approach to these special gaging problems is a thorough understanding of the principles of kinematic design, particularly with regard to those principles dealing with restraint As an example, suppose we wish to locate a flat plate so that it will possess no erratic freedom It can be seen that if the plate is rested upon three points its position will be established as regards rotation about its longitudinal and lateral axis This can be seen by referring to Fig 10 where the plate is supported on points *A B* and *C*

The next step is to restrain this plate so that it cannot move along its lateral axis This is accomplished by applying pressure at points *D E* and *I* With gravity considered as holding the plate against the three points *A, B* and *C* we now have this plate restrained in all degrees of rotational freedom and all but one degree of rectilinear motion By adding restraint at points *G* and *H*, all degrees of freedom will be restrained and the object will be completely located

Point of Reference Needed

The importance of this concept is due to the fact that unless extreme care is exercised it is difficult to make surfaces holes and other components with sufficient accuracy that the position or location of a part will be definitely known In all forms of measurement it must be borne in mind that for each relationship desired there must be a surface or point of reference Application of kinematic principles establishes these reference points with assurance In nearly all instances a well worked out kinematic design is less expensive to build and retains its precision longer than will other arrangements

The most common problem encountered in the design of special gaging fixtures is that of determining the size of a round shaft or of a hole, such as a wrist pin to fit a piston for an automobile engine, or the selection of rolls for a roller bearing There are two general methods of accomplishing this result The first is to measure the actual diameter of the shaft by such a set up as that shown in Fig 11 Here we have a lateral rib *A* placed directly under the measuring contact, with a second rib *B* used to control the horizontal axis of the work and keep it normal to the spindle of the indicator Often a second indicator will be placed above strip *B* so that any difference in diameters will thus be shown immediately

The shaft may be rolled under the contact point and the maximum reading of the hand will indicate the relationship between the diameter being checked and that of the master with which the gage was set In some instances it is an advantage to place a backstop as shown so that the work can be placed in the fixture easily and care need not be exercised to watch for the maximum reading of the indicator Wherever a backstop is used, the gage should always be set with a master of the same shape and equal in size to the nom

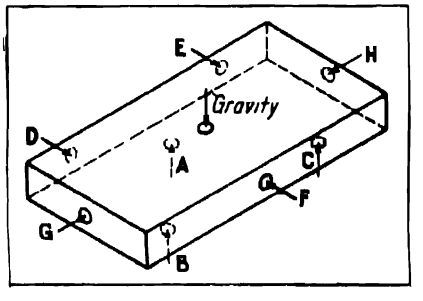


Fig 10—Restraint at the points shown will locate this plate in definite relation to a given reference point

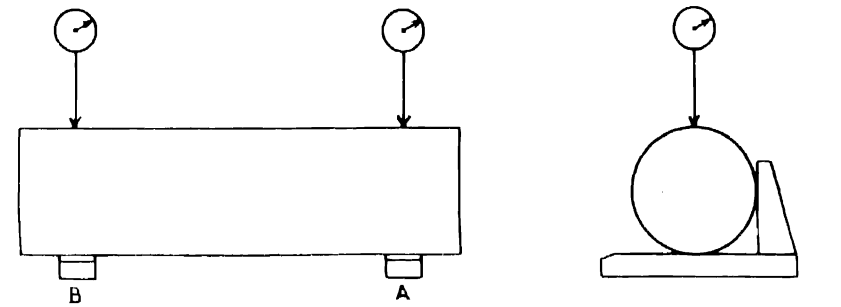


Fig 11—This set-up will give direct indicator readings of relationship of diameter of the shaft to the master with which the gage was set

inal size of the work being checked This is because it is difficult to set the backstop so that it will bring the work to a position where the exact diameter will be measured

If a gage such as that shown in Fig 11 is set with size blocks and the backstop is located with an error equal to Y' then the false diameter reading D of a piece having a true radius R will equal

$$D = R(1 + \sqrt{1 - \left(\frac{Y}{R}\right)^2})$$

This equation will hold good whether the error Y is plus or minus

The second method of determining the size of a round shaft, now find

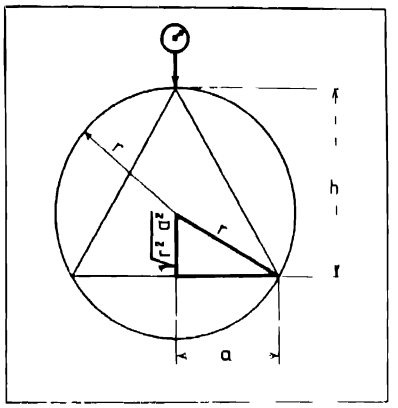


Fig 12—Determination of diameter by measuring the altitude of an inscribed triangle sometimes gives more accurate results than do direct measurements

ing application in many special cases is that of determining the altitude l of an inscribed triangle as in Fig 12 With this method it can be shown that

$$h = r + \sqrt{r^2 - a^2}$$

Differentiating h with respect to r

$$\frac{dh}{dr} = 1 + \frac{r}{\sqrt{r^2 - a^2}}$$

From this it can be seen that the indicator will not show directly the change in diameter If we call ΔD the change in diameter then ΔH (the change in h) will be

$$\Delta H = \tfrac{1}{2}\left(1 + \frac{r}{\sqrt{r^2 - a^2}}\right)D\Delta$$

By proper graduation, the dial of the indicator can be made to read the change in diameter directly

The particular advantage of this type of measurement comes in the checking of shafts that have been centerless ground Here the peculiar situation arises in which the shaft will appear truly round when measured with a micrometer caliper, as all readings of the micrometer will be the same In reality the shaft *may* have the form shown in Fig 13



Dial indicators find wide use in the construction of special gaging fixtures Practically any complex measuring problem can be solved with a properly designed unit like the one shown

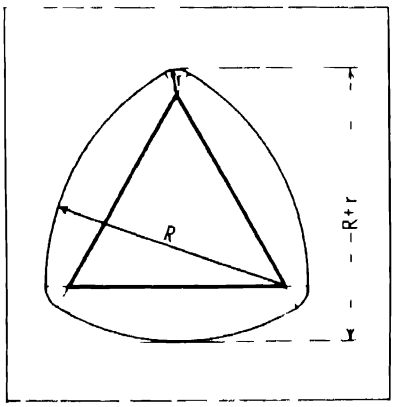


Fig 13—Shafts ground to this form will seem truly round when measured between parallel planes A more accurate reading is possible when the shaft is rotated in a V block

By examining this sketch it can be seen that regardless of how a measurement is taken if the measuring device consists of two parallel planes the distance between the planes will be $r + R$ at all times However, if this shaft be placed in a V block a definite change in reading would be obtained when the shaft is rotated This type of out of round shaft usually is triangular but it can have any odd number of sides

The final article in this series by Mr Street will appear in an early number

Straightening Magnesium Castings

By ROBERT T WOOD
Ingot an Magnesium Corporation

THE STRAIGHTENING of magnesium sand and permanent mold castings is an operation in which experience and skill are the necessary requisites for success So far as it can be put down on paper our practice in straightening magnesium alloy castings is to heat the casting rather quickly to about 130 F, place it under a press with proper support and deflect the casting *fairly* to a point somewhat beyond the point of straightness to allow for spring back and then permit the casting to cool to room temperature in the press The amount of extra deflection to allow for spring back can only be determined by experience and varies with the type of casting being straightened

The temper of the casting to be straightened is important We never try to straighten castings after aging but always do this work when the castings are either in the as cast or the solution heat treated condition Again after specifying the temperature to which the casting is heated and the type of equipment to use for straightening there is little else to say, the success of the operation depends entirely upon the skill of the operator

No excuse for accidents

BY EDWARD KANN

Every "accident" has a cause. Mishaps with power presses are no exception. Here's the way most can be prevented

THERE IS NO REASON why power press accidents should still happen. If a careful analysis is made of their causes it appears that each is avoidable. In this article is told how in the main stamping department of the Philips Radio Company, Eindhoven, Holland, with 150 presses from 3 to 400 tons, the number of severe accidents yearly was brought down from about five to zero.

Statistics show that practically no accidents happen to die-setters, who generally are skilled mechanics and are supposed to do their work with more care than the less skilled operators. The latter are very often girls, who seldom pay much attention to safety, their only aim being high production resulting in high earnings. Therefore it is good practice not to rely upon the operators' good intentions. In other words, it should not only be made *unnecessary* for the operator to put his hands into the danger zone, but it should be made *impossible*.

Completely inadequate, for instance, are pliers, tweezers and even sliding dies, if used without any other guarding. Many accidents are caused by an operator tripping the press while trying to adjust with his hand a badly positioned blank which was loaded with a pair of tweezers. It is clear that in cases like this the tweezers, pliers or slides did not prevent the accidents because they did not make the access to the danger zone *impossible*.

Operations performed on most presses can be classified in two groups. Group No. 1 are hand operations on strip stock and Group No. 2 are hand operations on blanks or performed parts, so called "second operations." It is not claimed that this classification is complete; but other groups, such as automatic feed, call for guarding methods to be individually developed in every case.

Group No. 1—Feeding strip stock. A fixed guard should be used, preferably one fixed to the tool. A so-called "box tool" is very suitable for the purpose though a tool in a die set can also be fitted with a fixed guard. The press should not have a longer stroke than the operation calls for. The tool should be totally enclosed by the guard and the stock openings should be too small to allow fingers to get in. If necessary compressed air should be used to blow out blanked or formed parts. No opening should be allowed at the front of the tool for removing sticking parts by hand. Wire hooks operating through a small hole should be provided.

Group No. 2—Feeding blanks. This group can be divided in two subgroups:

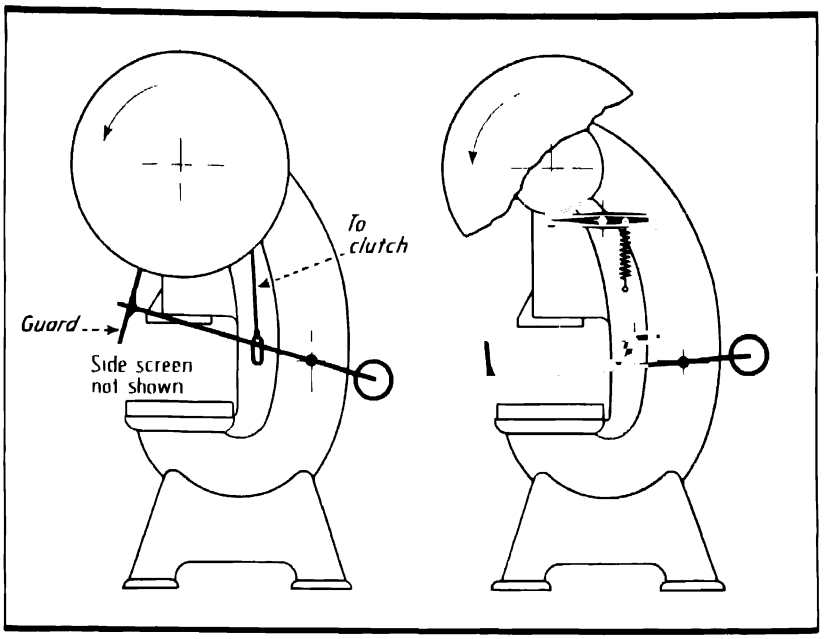
Subgroup No. 2a. Relatively large blanks of which only a part must undergo an operation. An example of this group is the piercing of a hole in the corner of a plate. In these cases it is nearly always possible to have part of the blank extend from the tool. This part is held by the operator and the tool or tool guard is provided with an opening too small to allow fingers to get in.

Subgroup No. 2b. Relatively small blanks which disappear entirely into the tool. This group is the most dangerous of all. In mass production of small parts this is also the most common hand operation and, as a result, the one responsible for the most accidents. Not only do tweezers, pliers, slides, chutes, vacuum feeders, etc., fail to meet the requirements of *impossible access*, but neither do two-handed devices, sweep guards and pull-away guards. These last three are not as objectionable as the others, as their intention is to bar access at the moment of danger. But they are too dependent upon proper adjustment and are very easily subject to abuse. This is not mere theory, as statistics show a considerable number of accidents where these three types have failed.

Sweep guards and pull-away guards are known as "secondary action" guards, as their action starts only after the press ram has been put



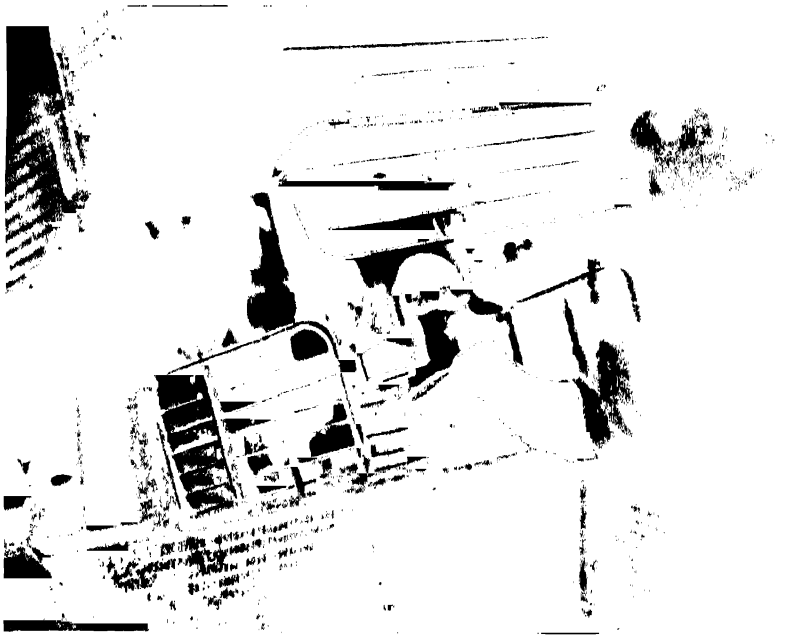
Totally inclosed tools are the safest, as it is physically impossible for the operator to put his fingers in the danger zone. A press stroke only long enough to shear the work must be used



Clutch-actuating guard of the pull-down type keeps the ram from descending until the guard is in position. A lost-motion link at the lower end of the clutch rod permits the clutch to be engaged only at the extreme lower point of guard travel, when it overlaps the bolster plate. A cam-operated latch (right) locks the guard until the upward stroke is nearly finished. Stationary guards, not shown, prevent access to the danger area from both sides

DESPITE THE WAR

While Mr. Kann was on the high seas, his country became a major battleground. The reader's guess as to present safety in Mr. Kann's factory — if it is still there—is as good as ours. However, since the principles discussed are as valid as before the blitzkrieg, no attempt has been made to delete reference to the Holland plant where his methods worked so well.



Greater production, resulting from higher press speeds and increased operator confidence, is achieved with the pull-down type of clutch-actuating guard. Only after the guard is in place is the press tripped

in motion. These guards will never prevent the press from making a stroke.

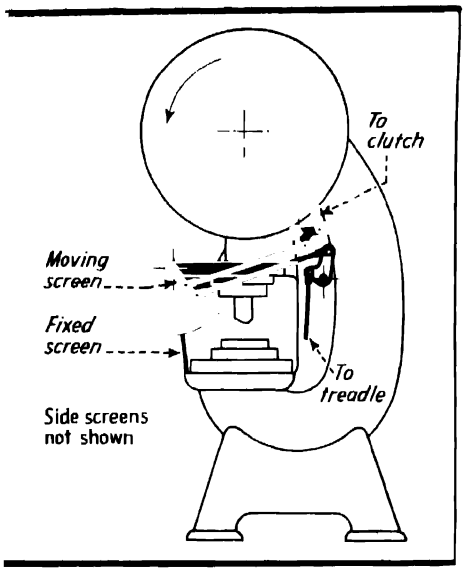
To meet the requirement of impossible access at the moment and in the zone of danger, a guard must be of "primary action." The guard must be fully closed before it is possible to trip the clutch.

There are a few such guards on the market in the United States. Generally they are moved by the treadle and are so interlocked with the clutch mechanism that the latter will not work until the guard is fully closed. Guard movement may be horizontal or vertical. These guards should consist of more than a bar or a sweeping loop. They must have a screen made of wire, perforated metal, or transparent plastic framed in metal to prevent any possible access to the die. Sides should not be forgotten; they may have stationary screens.

A very efficient type of primary action guard is the clutch-actuating guard. When studying the development of primary action guards, logic leads one to this most simple solution: Why not do away with handles and treadles and use the moving screen to actuate the clutch? After inserting a blank in the die the operator pulls the screen down and only after this screen fully shuts off access to the danger zone is the clutch rod pulled down. A simple cam-actuated latch keeps the screen down until the press is safe again.

This type of guard is the safest of all. Even if somebody removes the screen there isn't much left to trip the clutch with. In any case it would be more convenient for the operator to replace the screen. The speed with which such a press can be operated exceeds the speed of a two-handed device, and it does not depend on the size of the tool. This fact is pointed out because sliding dies become very lazy in operation when they involve appreciable masses.

The clutch-actuating guard is part of the press and not of the tool. Its working area should be the entire surface of the press table, so it will take the largest tools. No adjustments are ever required when tools are changed. Thus no fear should exist for accidents caused by maladjustment. All linkages in the mechanism are of



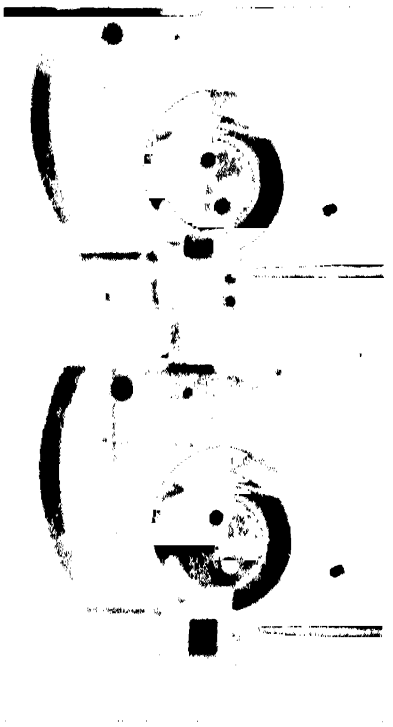
This foot-operated clutch-actuating guard moves easily, as the screen has little mass and there is no counterweight. A cam-operated latch similar to that on the pull-down guard, not shown, is also used with this device

fixed length. Forks should be welded to rods, not threaded.

One should be very careful in choosing the correct kind of guarding. If the work belongs to category 2b and one wants something really foolproof, the system just described is recommended. The treadle-operated primary-action guard is less foolproof as it does not prevent the press from being tripped while the screen is removed. In shops where supervision is always sufficient, however, this system may be used with advantage. If correctly designed, it will operate with still higher speed than the hand-operated clutch-actuating guard, as the operator has both hands free. With some guards of this type now on the market, not enough attention has been paid to the ease with which the pedal is moved. If by a few inches of pedal travel a heavy screen must be moved some twelve inches, a counterweight lifted about the same distance and a clutch tripped, it is no wonder that operators complain of heavy working. Also very little attention has been paid to the lessons of motion study. A guard of this type, illustrated, can have small screen travel, no counterweight and still give ample access to the tool. Movement of the screen is in the same direction as that of the hands. Removing the screen disconnects the tripping mechanism.

Primary-action guards cost from about fifty to several hundred dollars according to the size of the press. But in all cases they will pay for themselves. First in bringing down the cost of tools. The guard has to be paid for only once, but the excess cost of tool slides is incurred every time a new tool is made. Second, the increase in speed will bring a profit. There is no doubt about this increase; it is a proven fact that operators increase their speed if they feel absolutely safe. Third, the insurance premium is brought down if efficient guarding is installed.

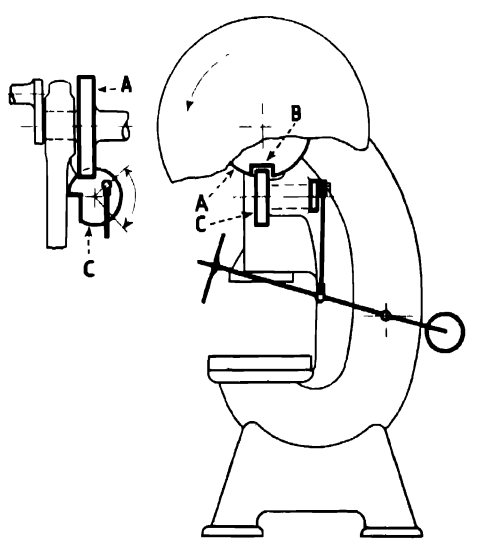
There remains one point to be considered. That is the danger of repeat strokes. There has been some confusion about the definition of a repeat stroke; in this article any stroke for which the press has not been tripped is called a repeat stroke. So-called anti-repeat devices do not prevent repeat strokes. They should be called single-stroke devices. Repeat strokes are always the result of some clutch defect. Every press builder will claim, of course, that his product cannot repeat, for he has incorporated some marvelous contraption or other, especially designed to prevent the clutch from misbehaving. He does not consider, however, that in spite of all his ingenuity, his customer may forget to oil the clutch or neglect a timely inspection. Minor things such as a weak spring, a sluggishly moving spindle or a damaged key, might cause an unexpected stroke.

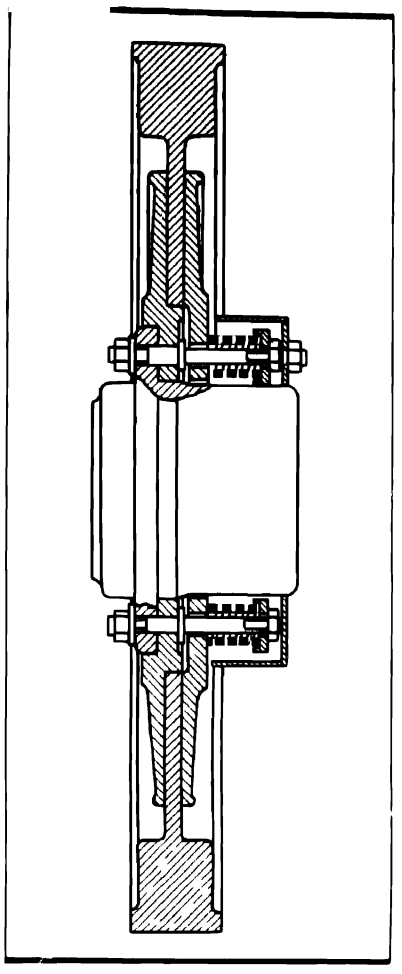


Repeat or unintentional strokes are prevented by locking the crankshaft until the guard is in position. Collar A on solid crankshaft has a notch B engaged by an oscillating stop C controlled by the guard. This mechanism must be rugged, as it absorbs all the energy stored in the flywheel. In presses of over five tons, a friction flywheel must be used to limit the torque to which the locking device is subjected. Above is the stop as installed on a 40-ton press, shown both locked, and unlocked

Repeat Stroke Prevented

The same logic that leads to the clutch-actuating guard will also lead to the solution of the repeat-stroke problem. Suppose something goes wrong in the clutch and it suddenly engages by itself. How can we then hold the ram or the crankshaft? Only by locking it with something that is stronger than the clutch. How this can be accomplished is shown in an accompanying illustration. The crankshaft is locked as long as the guard is not fully closed. It is realized that such a stop mechanism is quite unconventional, but it has proved to be very efficient. If the clutch is engaged while the crankshaft is stopped the belt will slip. Or, in case the press is driven by a small individual motor, the motor will stop. It stands to reason that this device must be of solid construction as it has to withstand an impact of the full accumulated energy of the flywheel. This makes it rather difficult when dealing with presses of more than five tons capacity. The enormous forces involved might easily damage either the stop or the clutch. Therefore on all presses exceeding five tons an overload relief should be incorporated, a very simple one being





Springs of the friction flywheel are adjusted to the correct pressure and the cover sealed to prevent unauthorized persons from giving them an extra turn

a friction flywheel The spring tension can be adjusted so that no greater torque is exerted on the crankshaft than it is intended to have Should this maximum be exceeded by the stop mechanism coming into action the flywheel will slip Repeat strokes too are prevented now

For small and medium size presses in the average mass production press shops, the following guards are recommended (for hand feed only)

1 Feeding strip fixed guard on tool
2 Feeding blanks
  2a Operation on part of blank fixed guard on tool
  2b Operation on entire blank primary action guard plus crankshaft stop plus friction flywheel

The devices described under 2b were developed at the Philips Company's works during the last seven years All initial troubles have been overcome and a standard construction has been giving full satisfaction for several years It is realized that only large factories having a number of presses of which many are of the same model, can afford to make such alterations Others must depend on what the various press builders eventually will do

Some progressive press manufacturers already have adopted a primary action guard as standard equipment But presses are sold in a competitive way and the additional cost of crankshaft stops and friction flywheels seems at present prohibitive, even if made on a production basis However, the imperfect positive clutches are being superseded more and more by friction clutches On the larger presses this is already a fact and there is a trend toward friction clutches on medium size presses also As soon as this is achieved the requirements described above are met half way as the addition of an extra friction member will then be superfluous To complete these presses with a crankshaft stop is the last step

Precision Forging

By LUCIEN I YEOMANS

THIRTY EIGHT years ago I made a number of gray iron castings with holes cast within a thousandth of an inch of the desired diameter and in fact made press fits for cold rolled shafts by casting It seemed to be a promising practice that would save a great deal of labor

Six months later it was abandoned as impracticable not because it could not be done but because in large production the necessary care and attention to detail could not be secured

The process followed was described on September 1 1902 (*AM* page 1263) at the request of Fred J Miller then editor who had seen the work at Antrim N H and had become so enthusiastic over its possibilities that he wrote of it editorially on August 7 1902 (*AM* page 1141) as follows

> In our present issue among the Letters from Practical Men will be found one entitled Micrometrical Precision in Iron Casting The letter is quite unpretentious in appearance except perhaps for its title which did not originate with the writer of it We depart a little from our usual practice to commend it to the special consideration of the classes of our readers to whom it should be of interest To molders it first appeals indicating a distinct and profitable advance in a detail of foundry practice not yet familiar to the entire trade and probably known to only a very few The foundry is not the place where we have been in the habit of looking for the minute precision which the title that we have given to the paper would seem to indicate but the story which the writer tells we believe to be entirely without exaggeration, as we have seen some of the castings of which he speaks The results accomplished being as described they of course speak of opportunities of economy to the machinist and the shop proprietor They suggest changes in machine shop practice and a different planning and doing of certain lines of work In agricultural machinery in textile machinery and various other lines the amount of drilling and boring involved is a considerable item of the entire work and the saving of most of this as suggested by our foundry friend is really a gift of great value to the machine trade Of course the process as described carries with it suggestions both as to the limitations of it and as to its possible extension On account of the shrinkage holes of large size cannot be cast with the steel core an inch being here mentioned as a limit but this suggests the extension of the process to the production of external surfaces with the same precision and finish as is possible with the holes so that the field of experiment suggested by the letter is a wide one The letter is also another notable example of the readiness of the American mechanic to tell of his improved methods or as some might put it to give away his competitive advantages Doubtless he will continue to do this thing and it is our pleasure to help him in it as we have the opportunity believing that just here is the practice which more than any other tends to raise the standard of American machine shop practice

This is analogous to forge finished cavities in shell Both can be done on a relatively small scale, under close supervision, at abnormal cost of maintenance, but neither would be successful in mass production

There are a great many things that enter into it besides the considerations suggested by John Haydock (*AM* Vol 84, page 581) and I am afraid he has been sold on it ill advisedly, as Mr Miller was on my castings on that strangely coincidental August 7, nearly forty years ago

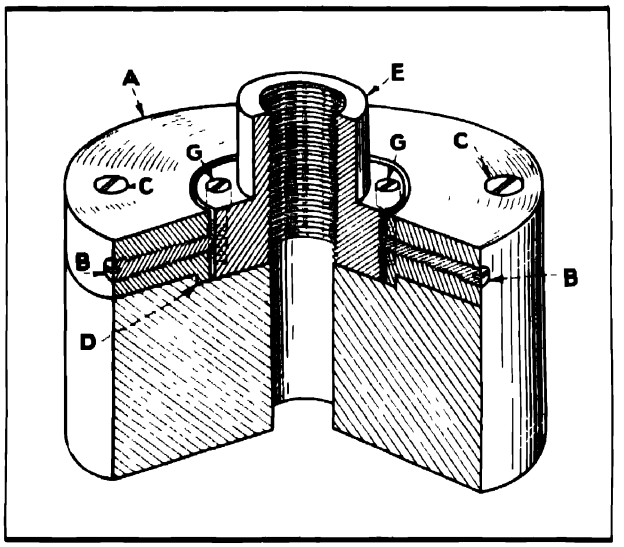
As for me I have gained a lot of experience in the last 38 years which I did not possess when I was 24 years of age and on my first superintendent's job, and I predict that shell may be made with finish forged cavities up to about 105 mm , but not as well or as cheaply as if the cavity is machined, and above that size it is decidedly impracticable and will not be continued long in emergency mass production

IDEAS FROM PRACTICAL MEN

Make Universal Chuck Run True

By C. FAUST

The writer has found that the following changes in a three-jaw universal chuck will make it run true. First construct ring *A* of width equal to the length of headless set screws *B*, holes for which are drilled and



When a three-jaw universal chuck fails to run true, the chuck can be mounted on a spindle adaptor on which the chuck can be trued with the aid of screws

tapped in the ring. Remove the screws *C* which hold the chuck together, and drill holes in the ring so that it can be lined up with the screw holes in the chuck. A shoulder *D* is turned on the back of the chuck and on the ring so that the latter will be centralized.

Ring *A* is fastened to the chuck as shown in the drawing. Turn adapter *E* to hold the chuck on the spindle, leaving about $\frac{1}{16}$ in. play adjacent to the ring. Drill holes in the adaptor, $\frac{1}{2}$ in. larger than screws *G*, so that it can be moved. When placing round work in the chuck, indicate and true the chuck by screws *B*. The chuck will run true after screws *G* are tightened.

Auto Transmission Varies Lathe Speed

By FRANK C. HUDSON

Whether or not the automobile type of geared transmission originated in the machine tool field, as some insist, these transmissions have a way of working back into machine drives in various places. The last I've seen is a four-speed Reo transmission salvaged from an old truck that is now doing duty in the shops of the Mobile Pulley & Machine Company.

As line shafting was undesirable in their new pattern shop, they mounted the Reo transmission and a variable-speed motor on a casting bolted to the back of a lathe. Then two V-belt pulleys were mounted on both the lathe spindle and transmission shaft, those on the shaft being directly above those on the spindle. The two V-belts from the back end of the transmission therefore give four spindle speeds for each motor speed. Small pattern work is done over the lathe bed. For large work, the back end of the spindle, extended to overhang the bed, is threaded to carry a face plate that revolves in a pit in the floor; this is covered when not in use.

Welded Smoke Stacks Replace Cast Iron

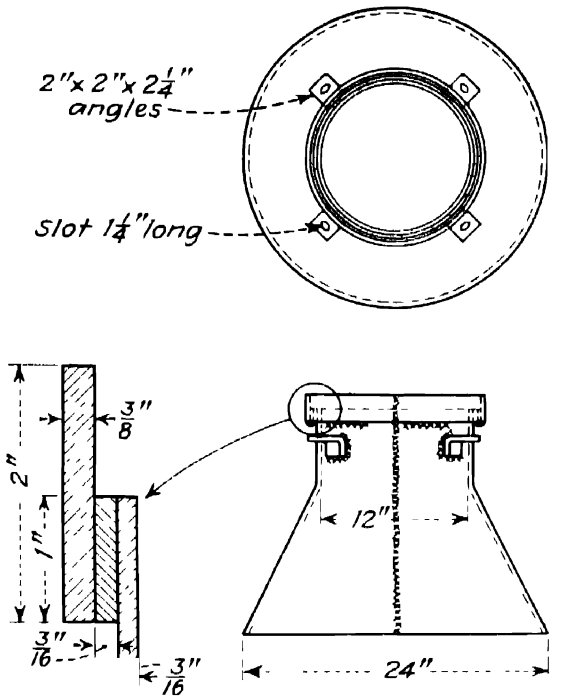
By A. H. CARROLL

Until quite recently it has been the popular opinion that locomotive smoke stacks and petticoat pipes or smoke-stack extensions had to be made of cast iron in order to give satisfactory service. Such stacks are $\frac{3}{4}$ in. thick and often cost $100. But this cost can be reduced materially by making the parts from welded steel plate.

Contrary to general opinion, steel plate does not



Locomotive smoke stacks can be fabricated from welded steel plate, and are as serviceable as those of cast iron. When cinder cut, the steel stacks are easily repaired by welding



This all-welded petticoat pipe is designed to fit the welded stack. Both replaced cast-iron parts at considerable saving in first cost and repair charges

wear away any more rapidly than cast iron. Due to the weldability of such plate, it is a simple matter when the plate becomes cinder cut to remove the worn portion and weld in a new section. Cast iron parts are generally scrapped when worn.

The construction of the steel stack is very simple. A boilermaker and helper, without any special equipment, can cut, roll and prepare the entire assembly for welding in about seven hours. The welding takes even less time. The body of the stack is made from ⅜-in. tank steel and is rolled in one piece with a taper; usually 1 in. in 12 in. The smokebox flange is flame cut to size, its diameter being 10 in. larger than the outside diameter of the stack; the hole in the flange for the stack fit is not cut out until the plate is rolled to the curve of the smokebox. Then the center of flange is removed by flame cutting. The flange is finally located in its proper position on the stack and tacked welded securely. A piece of half-oval 1½ in. steel is rolled to fit the outside diameter of the top of the stack and is tacked in position. Four pieces of 2 x 2 x 2¼-in. angles are welded 90 deg. apart on the periphery of the stack for petticoat attachment. The entire assembly is then welded with coated rod.

The petticoat, shown in the drawing, is a little more difficult to roll due to its abrupt taper. Best results and the greatest accuracy are obtained by using ordinates spaced a couple of inches apart and keeping them parallel with the rolls at all times during rolling. After the skirt is rolled, the top is formed to fit and is tacked to the skirt. There are two pieces of flat iron, one 3/16 x 1 in. and the other ¾ x 1 in., needed for the joint at the top of the petticoat.

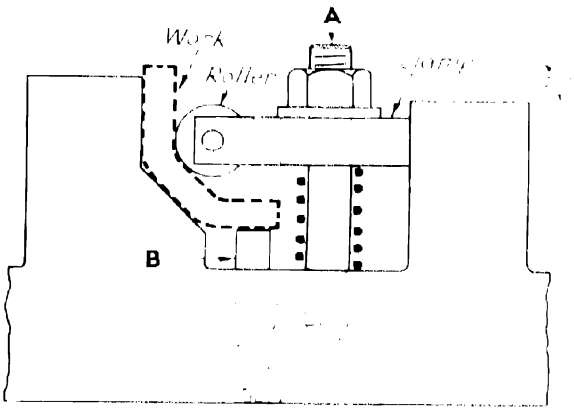
Many front ends are so constructed that it becomes necessary to remove part of the petticoat skirt, especially when space is limited between smokebox plates and the stack. When this occurs, part of the skirt is removed by flame cutting, and a flat plate is substituted, the latter being bolted to the skirt. Four pieces of 2 x 2-in. angle iron, with slots in one flange to take ¾ in. bolts, are welded to the petticoat to hold the flat plate.

Clamps for Holding Work of Odd Shapes

By C W HINMAN

The illustration shows a simple and very effective principle for quickly clamping and rigidly holding certain types of odd-shaped pieces in drilling jigs, milling and tapping fixtures, or on a planer bed.

The pieces to be clamped may be a large casting, a rolled section, or sheet-metal work formed in dies. An elongated slot through the clamp and around stud *A* allows the clamp to be moved horizontally when inserting and removing the pieces. When the work is



This roller-type clamp embodies several principles which can be adopted for holding odd-shaped pieces in drilling jigs, milling and tapping fixtures, or on a planer bed

inserted in the fixture, it is supported by spring-pin *B*, which is depressed when the clamp is tightened.

The use of a coiled compression spring for raising the clamp is optional. This type of clamp and roller holds the pieces securely when the nut is tightened, regardless of variations in shapes and thicknesses of work. The 45-deg. angle and the general design can be varied, of course, to suit other shapes and conditions of work than that shown.

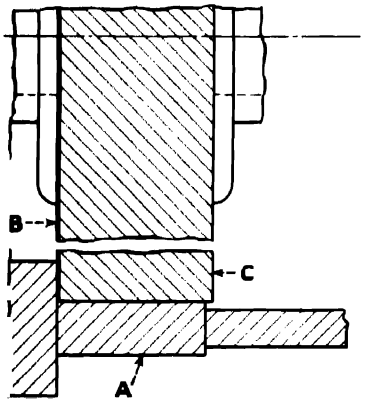
The Solution of a Difficult Grinding Job

By ARMEN TASLYIAN

In grinding a quantity of shafts such as the one shown at *A*, we were forced by circumstances to use a wheel of softer grade than would apply to the aver-

age case. Since the grinding was done by the plunge-cut method and no clearances or grooves were permissible at the interior corners of the shoulders, we had difficulty in grinding them sharp.

However, we solved the problem by cementing the thin shellac-bonded cut-off wheel *B* to the side of the regular wheel *C*, the hole in the cut-off wheel being enlarged to 5 in. so as to clear the clamping collar on



Difficulty in grinding sharp interior corners at the shoulders of shafts was eliminated by using a cut-off wheel cemented to the side of the regular grinding wheel

the wheel spindle. The only matter out of control was that the parts ground by the cut-off wheel were 0.0005 in. oversize, due, of course, to the difference in hardness of the two wheels. But the oversize was soon reduced by holding a small oilstone in the interior corners while the shafts were revolving.

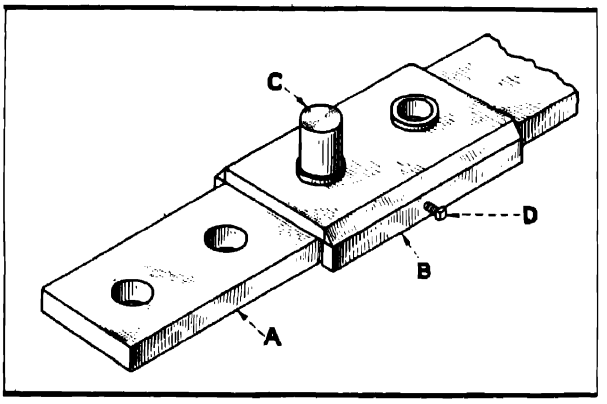
Sliding Drill Jig Spaces Holes

By JOHN E. HYLER

A sliding jig of the general type shown in the illustration may be used for spacing a row of holes in a straight line and at given distances apart. Three pieces of steel are simply welded together as indicated by *B* to fit over the workpiece *A*.

The holes are positioned in such relation in the jig that by holding it flush with the stock at the first end for beginning, and locking the jig on the work with the set screw *D*, the first two holes will be drilled through the bushings in proper relationship with the end of the work. Then the screw *D* is loosened and the jig is moved along until the dowel pin *C*, somewhat pointed and ground to an easy push fit in the holes being drilled, can be inserted in the last of the two holes drilled. Another hole is then drilled through the open bushing. This process is repeated until all the holes have been drilled.

A number of holes and bushings of varying spacings may be provided in the same jig. By using a predetermined sequence of hole selection, required variations of hole spacings may be produced in the work.

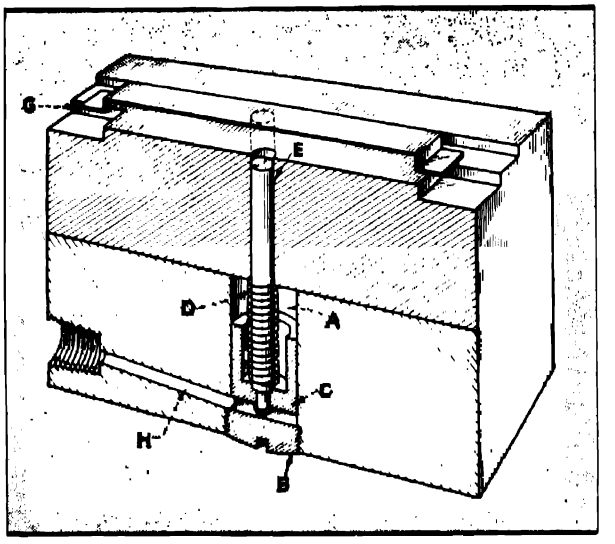


Although this jig is designed for drilling but one hole at a time, its principle can be applied to any predetermined hole selection and spacing

Plunger Aids Air-Operated Ejector

By H. R. HAGEMAN

Upon attempting to eject steel plates from a forming die by means of compressed air after a shallow forming operation it was found that any reasonable volume of air, no matter how applied, would merely



This air-operated plunger with a knockout rod attached was designed to eject steel plates from a forming die when compressed air alone would not do the job

lift the plates slightly but would not eject them. The difficulty was overcome in a very simple manner as shown in the drawing.

A $\frac{1}{2}$ in. hole *A* was drilled and reamed through the die shoe in direct line with the $\frac{3}{16}$ in. hole already through the die steel. The bottom of the hole was closed with a threaded plug *B* thus forming a cylinder in which a piston *C* of cold-rolled steel was made to slide freely. The piston was bored out from the top to provide space for a very light spring *D* used to insure the return of the piston to the bottom of the cylinder when the air pressure was cut off.

A rod *E* moving freely in the $\frac{3}{16}$ in. hole was mounted in the center of the piston and was of proper length to deliver a positive blow to the bottom of the plate *G* to be ejected, thus knocking it clear of the nest. The air entered the cylinder through a port *H*.

"AN"

BY



Wide World photo

TANKS BY THE TON

IN WARFARE, a tank must have speed and maneuverability; it must have a hull tough enough to withstand gunfire and fire power enough to make an effective attack. It isn't easy to turn out a good tank.

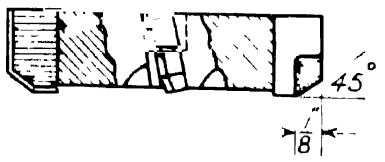
At the present time, the Rock Island Arsenal is assembling an order of 34 combat cars and is underway on an order for 126 medium tanks. The Arsenal has pioneered and experimented on production methods for making these tanks. In the course of this work, it has discovered several "choke" points in manufacturing. Some of these are: machining the cast armor plate, the large diameter ring which forms the track for the turret, the 37-mm. gun mount yoke and the track sprockets, and riveting the hull.

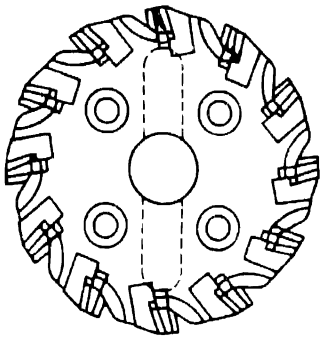
The hull and vulnerable parts of the tank are made tough, or projectile resistant, by using rolled armor plate where sections are flat and cast armor plate where the contours are other than flat. The rolled armor plate is purchased, heat-treated and machined, ready for assembly in the hull. Cast armor plate may or may not be received heat-treated but is machined at the Arsenal.

Machining the armor plate is one of the most difficult operations in tank manufacture. Armor plate is selected according to the ballistic properties which are determined by firing tests made on each heat of castings. The grain structure must be suitable or the material will not have the proper combination of hardness and toughness required to withstand the piercing effect of a 37-mm. shell. Desirable ballistic properties are found in a wide range of hardness, thus making it difficult to establish fixed and definite rules for machining the material.

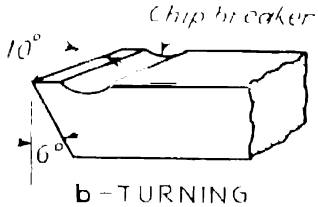
While experiments are underway at the Arsenal on heat-treatment which will give a material of good ballistic properties and good machining properties these have not advanced to the stage

FIG. 1

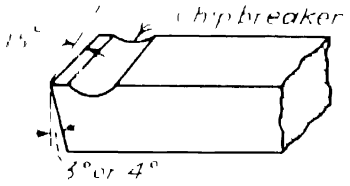




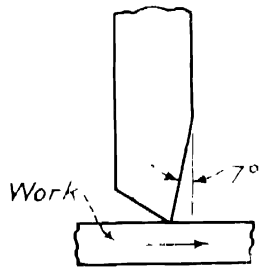
a – MILLING



b – TURNING



c - PLANER



d

where the machining procedure can be made absolutely uniform. However, for the present, certain general rules for machining armor plate do apply. All cutting must be done at low speeds, much slower than for alloy steels. It is better to run slow with a heavy cut. The cutter must be kept moving right through the material and not permitted to slow up. For example, a milling cutter must be running before starting into the work and must move into the work continuously and slowly. If it is permitted to idle or to take very shallow cuts the material will glaze over, become almost impossible to cut, and the tool will dull rapidly.

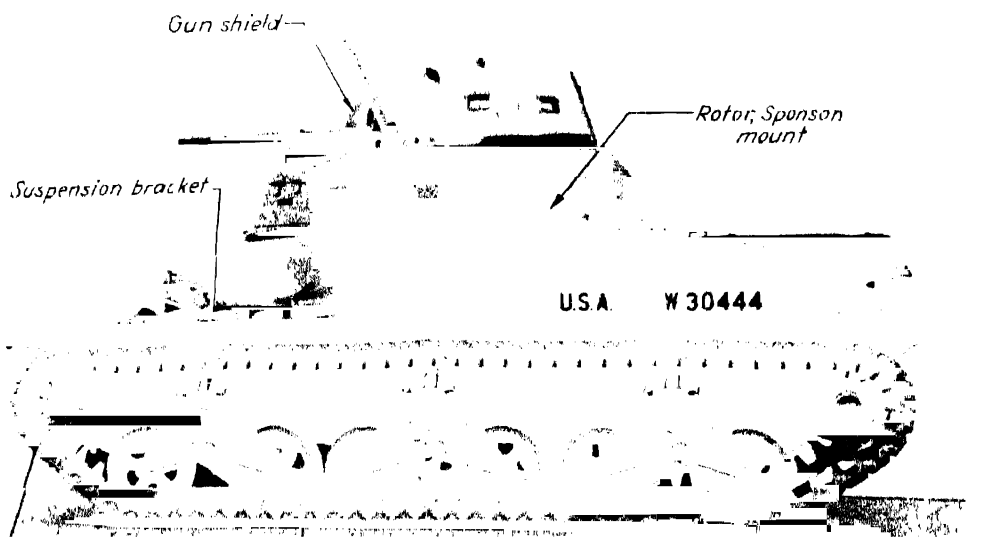
High-speed cutting tools such as Apex, Rex AA, Illinite, Columbia CC have been used. Stellite 2400 has been applied successfully. A cobalt-molybdenum-tungsten (8-8-1½) alloy has been used for drills and reamers.

Milling cutters should not have a rounded edge. They have been found to operate best with a 45 deg. angle at the tip as shown in Fig. 1*a*. Turning and planing tools ground as shown in Fig. 1*b* and *c* have been found satisfactory. Another method of grinding tools to get a shear cut in planing or shaping is shown in Fig. 1*d*. With the tip of the tool higher than the point it has been found that there is less heating of the tool with consequent longer life and with less power consumption.

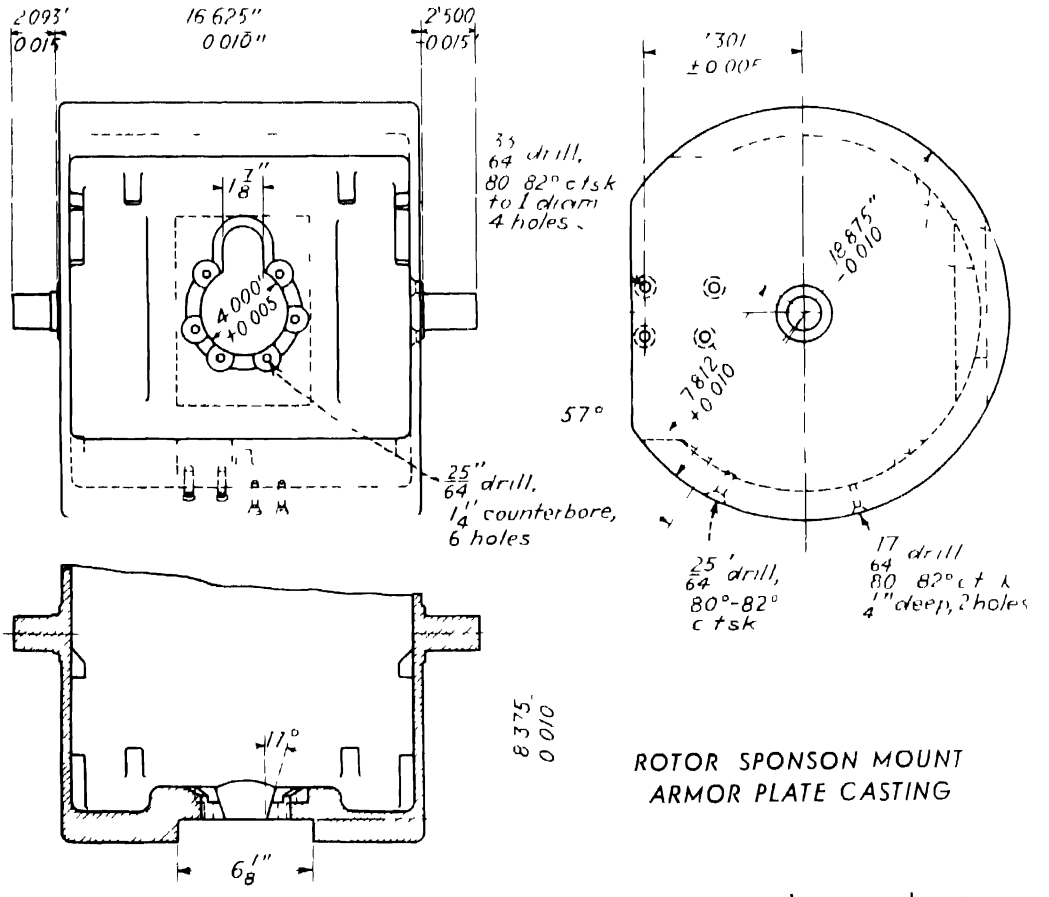
The difficulty in machining the internal parts of the tank is not one of cutting materials but rather that of handling the thin and sometimes complicated sections as typified by the 37-mm. gun mount, the turret ring and the track suspension brackets. Procedures for these will be outlined below.

One noteworthy point in machining these castings is that all of them are worked on general purpose tools. In many cases this work has to be done by mechanics of different grades of ability. Jig and fixture design, therefore, is important; most jigs must be made substantial enough to be ready for production runs of any desired amount. Many of them incorporate set blocks so that the machine operator need use only feeler gages, 0.01 in. in thickness to set his tools at the proper height or position. Targeting fixtures are used on all jigs for castings to equalize the material around the bearings and other cut-outs.

The choke point on the drive sprockets has been pretty well solved by cutting them four at a time on a Kellermatic. Both roughing and finishing cuts are taken in the same machine using two templets.



Cast Armor Plate Parts



ROTOR SPONSON MOUNT
ARMOR PLATE CASTING

The sponson mount rotor, heat-treated cast armor plate, is first mounted in a lathe where the ends are faced and the outer diameter and trunnions are turned. 0.025 in. of stock is left for a finish grinding operation. High-speed steel cutting tools are used with slow speed and soluble cutting oil is applied both to the tools and to the lathe centers





The trunnions and outer diameter of the rotor are finish ground using a 4-in. 46 grain 24-in. wheel running at about 760 r.p.m. with a slow cross feed while the work revolves at about 200 r.p.m. A soluble oil is used in this grinding operation. After grinding the rectangular slot which can be seen in the illustration is milled and the hole is bored to a tolerance of plus 0.005 in.

Operation Sheet for: ROTOR, SPONSON MOUNT

MATERIAL: Steel Casting, Homogeneous Armor Plate, heat-treated.

1. Snag grind inside of casting. *Note: Entire interior must be free from all roughness and sharp edges.*

   INSPECT

2. Layout trunnions for centers.

   INSPECT

3. Center drill trunnions.

   INSPECT

4. Place on centers and rough turn one trunnion for chucking.

5. Chuck the rough turned trunnion and rough turn trunnion on opposite end. Face opposite end allowing 3 32 in. stock all over for finish. Turn radius.

6. Rough face opposite end, rough turn trunnion on opposite end and rough turn outside diameter, allowing 3/32 in. stock all over for finish. Turn radius.

   INSPECT

7. Finish turn outside diameter, leaving 0.025 in. stock for finish grind. Finish turn trunnion allowing 0.025 in. stock for finish grind and finish face end. Finish turn trunnion on opposite end allowing 0.025 in. stock for finish grind and finish face end.

   INSPECT

8. Finish grind the 18.875–0.010 in. diameter.

   INSPECT

9. Finish grind trunnions.

   INSPECT

10. Drill three 33 64 in. diameter holes and drill and ream one 33/64 in. diameter hole. *Note: The hole to be reamed is the upper left hand hole in upper right hand view on drawing.*

11. Countersink four 33 64 in. diameter holes.

    INSPECT

12. Mill the 6⅛ in. slot, bore the 4.000 + 0.005 in. diameter hole and rough out the 17⁄8 in. angular slot with straight cutter.

    INSPECT

13. Finish mill the 17⁄8 in. x 17 angular slot.

14. Finish mill the 57 angular pad to the 7.812 0.010 in. dimension.

    INSPECT

15. Finish mill the 3⁄8 in. radius along flat side.

    INSPECT

16. Mill off center lugs from trunnions.

17. Remove burrs and sharp edges.

    INSPECT

18. Drill six 33 64 in. diameter holes in side of rotor.

19. C'bore six 33 64 in. diameter holes on inside of rotor 1¼ in. diam.

20. Drill and c'sink two 25/64 in. diameter holes and drill and c'sink two 19/64 in. diameter holes.

21. Remove burrs and sharp edges.

    INSPECT

22. Assemble spring in rotor.

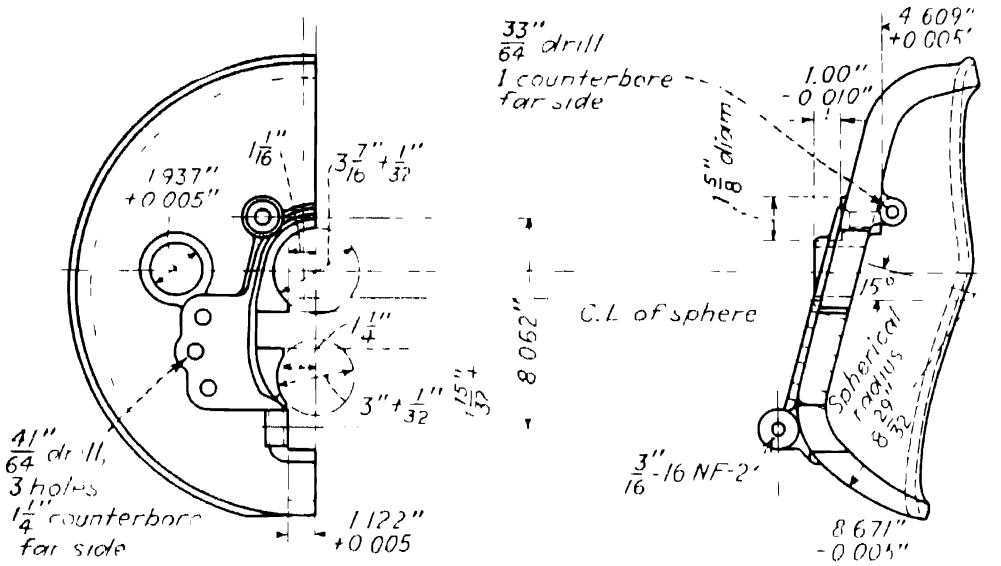
23. Grind pads to fit ammunition box.

    INSPECT

24. Paint entire rotor except two trunnions one coat of primer and paint interior with an additional coat of white enamel.

25. Slush trunnions to prevent rust.

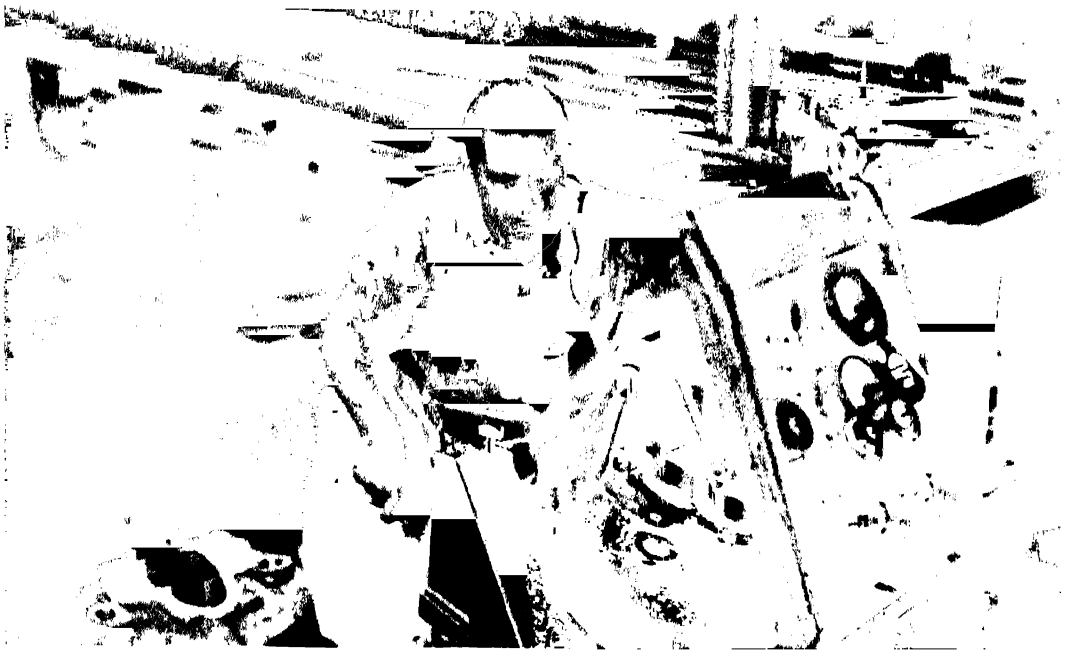
Cast Armor Plate Parts



SHIELD, RIGHT, ARMOR PLATE CASTING

Gun mount shields are cast in two halves with three lugs which are used for positioning in the fixture and are later milled off in the final machining operation. The sequence of operation on these shields is as follows: 1. Disk grind the joint face of castings; 2. Mill the bottom of the three locating pads; 3. Mill the joint face to 0.001 in. tolerance. After this the shields are worked in pairs beginning with the milling operation shown here. A 15-deg. angular pad is being milled on the outside face of the right and left shield at one time. A stop is built into the fixture for the cutter which is the only way of measuring the proper depth. Inserted high-speed steel blade cutter is turning about 14 r.p.m. with $\frac{5}{8}$ in. feed. Sulphur base oil is used. It has been found important in milling cast armor to grind the outer corner of the cutters at 45 deg. as shown in Fig. 1. This has been found to give better cutting and longer tool life





The gun mount shields are drilled and bored in pairs in a radial drill using the hinged top fixture shown here. High-speed steel or cobalt drills and reamers are used for these operations which consist of boring a $3\frac{7}{16}$ in diameter hole, a 3 in diameter hole, drilling a $\frac{41}{64}$ in. diameter hole, a $\frac{5}{8}$ in. diameter hole and taper reaming a 30 deg. angular hole, and drilling three $\frac{41}{64}$ in. holes. The fixture is arranged so that it can be tilted to permit drilling the angular hole. Feeds and speeds must be very slow. Feed must be continuous for if the cut is allowed to stop the tool will dull immediately. Sketch at the left gives general details of the part.

Operation Sheet For: SHIELD, RIGHT

MATERIAL: Steel Casting, Homogeneous Armor Plate, heat-treated.

NOTE: Shield, Left, manufactured in conjunction with this shield starting at Operation 6.

1. Disk grind the joint face of castings.
2. Mill the bottoms of three locating pads. Mill the sides of two pads. Mill the 4.609 + 0.005 in. dimension of the 1⅛ in. boss on inside of casting. *Note: These dimensions are taken from cutter set gages on fixture.*

   INSPECT
3. Mill the joint face. Mill the 1 1/16, the 1¼, the 1 15/32 slot, and the 1.122 + 0.005 in. dimensions.

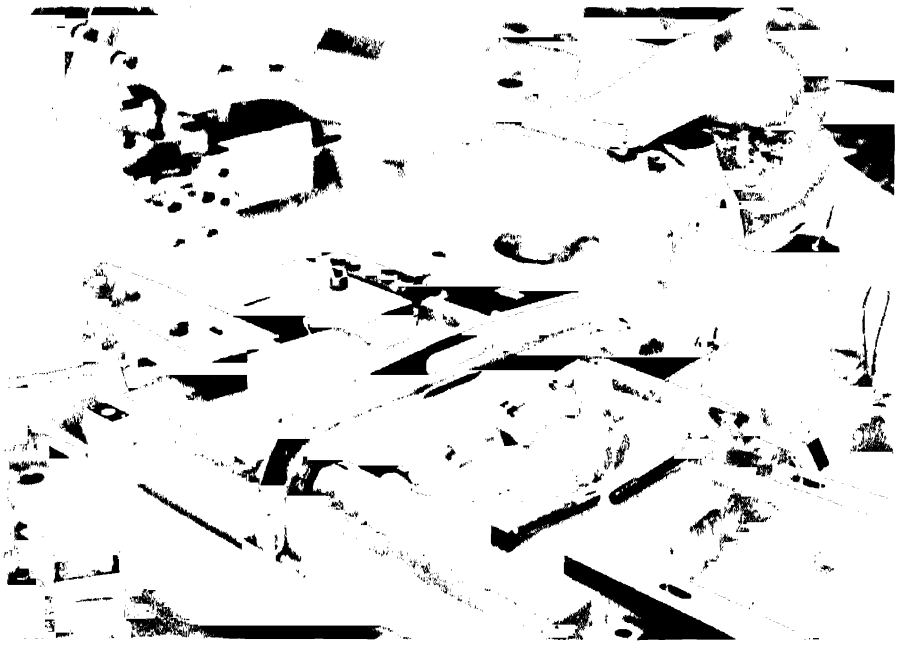
   INSPECT
4. Mill the relief notches in locating lugs on joint surface.
5. Remove burrs and sharp edges. *Note: Starting with the following operation, work in conjunction with shield, left, which has similar preliminary operations.*

   INSPECT
6. Mill the 15° angular pad on outside face. *Note: Shields to be machined at one time in fixture.*
7. Bore the 3 7/16 in. diameter hole. Bore the 3 in diameter hole. Drill the 41/64 in. diameter hole. Drill and ream the 1.937 + 0.005 in. diam. hole and drill three 41/64 in diam. holes in pad.
8. Drill the 33/64 in. diameter hole and tap drill one ¾ 16NF-2 tapped hole. Spotface the 33/64 in. diameter hole and tap ¾-16NF-2.
9. C bore the 1⅝ in. diameter and c'sink the 41/64 in. diameter hole. Spotface the 1.000 — 0.010 in. dim. of the 1.937 + 0.005 in. diameter hole. Spotface three 41/64 in. dia. holes on inside of casting.

   INSPECT
10. Mill off three locating lugs.
11. Remove burrs and sharp edges.

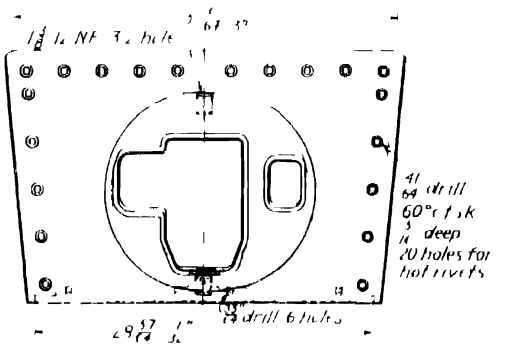
    INSPECT
12. Paint one coat of primer.

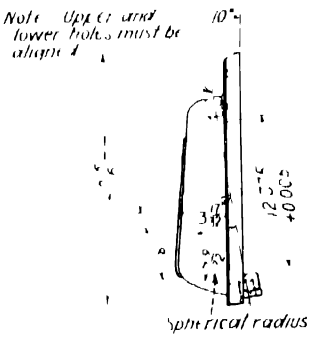
Cast Armor Plate Parts



The turret front plate casting is being set up here for the first operation of planing the four sides. An index fixture is used and a targeting arrangement centers the casting prior to clamping. Set blocks at the corners of the casting simplify setting the cutting tools. Apex type tools have been found satisfactory in these planing and cutting operations. A very slow feed and about $\frac{1}{8}$ in. cut has been found satisfactory. Tools are ground with very little rake or clearance. Holes for mounting the 37 mm. gun are drilled later at a horizontal boring machine.

PLATE ARMOR
PLATE CASTING





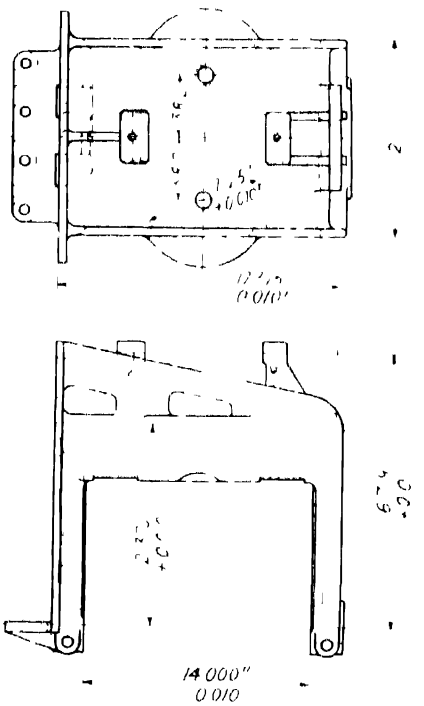
Operation Sheet for: PLATE, FRONT, TURRET

MATERIAL: Steel Castings, Homogeneous Armor Plate.

1. Solution heat-treatment.
   INSPECT & WEIGH
2. Sandblast to remove all scale.
   INSPECT & WEIGH
3. Reheat to critical temperature for 2½ hrs. Critical thickness ¾ in. Cool in freely moving air.
4. Sandblast.
   INSPECT
5. Plane the four sides of plate complete.
   INSPECT
6. Drill, bore, ream, tap the backface the 1⅜ 12-NF-3 holes.
   INSPECT
7. Mill the 3 17/32 in. dim. bosses.
8. Mill the 10° angular pad to the 4⅜ in. dim.
   INSPECT
9. Drill the twenty 41/64 in. holes.
10. Drill the six 33/64 in. holes.
11. Drill the two holes for ¼-20NC 3 tap.
12. Tap the two ¼ 20NC-3 holes.
13. Countersink the twenty 41/64 in. holes as shown.
14. Remove all burrs and sharp edges.
    INSPECT
15. Paint one coat of primer.



Miscellaneous operations on steel castings are shown in the accompanying two photographs. Above is shown the arrangement for planing the inner and outer surfaces of the track suspension bracket which has a hardness of 33 38 scleroscope. Six are set up at one time on the planer table. They are held rigidly in position by hinged arms which swing up between the castings. The ends of these arms are in the form of a yoke in which are two screws which can be extended by the hexagon nuts which are visible in the illustration. The position of the tools is determined by set blocks on the fixture. Note the special clapper type fixture used for the two center cutting tools

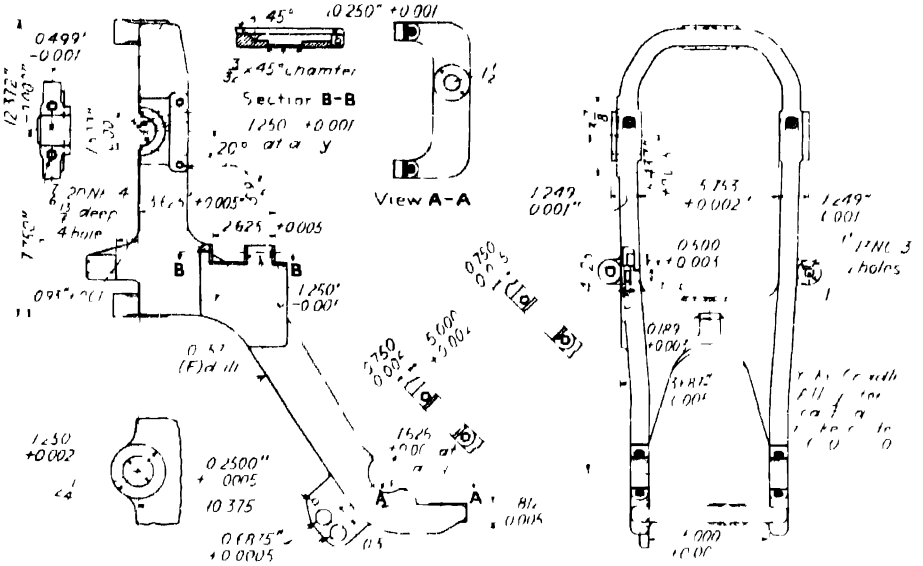


Cast Alloy Steel Parts

At the right is shown the set up for turning the conical face and key on the roller bearing housing which supports the turret. The fixtures are arranged on the table of a vertical boring mill so that the cutting tool generates the necessary angle to allow the roller carried by the housing to mate with the raceway on the turret ring shown on page 722. The set blocks for the key and for the face can be seen at the center and right. Three parts of these brackets support the turret. They must be mounted on a true circle that the turret will turn easily



Cast Alloy Steel Parts



Operation Sheet for: YOKE, CRADLE

MATERIAL: Alloy steel casting, heat-treated.

1. Paint one coat of primer and paint numbers 1 to 475 inclusive on castings.

2. Straighten.

3. Finish mill three locating pads. *Note: Rough mill the trunnion cap bearing faces and the 1.500 + 0.001 in. key seat of bearing cap leaving 1/32 in. stock for finish on these surfaces. Rough mill the 2¼ in. diam. bosses of pinion bearings on the inside faces leaving 1/16 in. stock for finish. Finish mill the three locating pads on the 1 in. diam. bosses.*

4. Remove burrs and sharp edges.

INSPECT

5. Spot and scrape the three locating pads on the 2¼ in. dim.

INSPECT

6. Rough mill the outside of two trunnion bosses and two pinion bosses leaving 1/16 in. stock for finish.

INSPECT

7. Rough straddle mill the inside faces of trunnion bosses leaving 1/16 in. stock for finish on all surfaces.

INSPECT

8. Rough mill the two notches on left hand side of yoke leaving 1/16 in. stock for finish on all surfaces.

INSPECT

9. Mill the 45° angular clearance for slotter cutter, using a 5/16 in. dia. end mill in Ecklund head.

INSPECT

10. Rough slot the 0.500 + 0.003 keyway, leaving 1/16 in. stock.

11. Remove burrs and sharp edges.

INSPECT

12. Re-spot and re-scrape the three locating pads if necessary.

INSPECT

13. Finish mill the trunnion bearing cap faces and the 1.500 + 0.001 in. keyways, and finish mill the inside faces of the 2¼ in. dia. boss of pinion bearings.

INSPECT

14. Finish mill the inside faces of trunnion bosses to the 5.753 + 0.002 in. dimension. Use standard 8 in. diam. cutters 1¼ in. wide by 1½ in. bore alternate angle.

INSPECT

15. Remove burrs.

INSPECT

16. Finish mill the two outside trunnion faces to 1.249 — 0.001 in. Finish mill the two outside pinion faces to the 7.750 — 0.001 in. from center of trunnion bores and the 12.372 — 0.002 in. over all dimensions. Finish mill the ¾ x 3⅜ in. pad on left hand side to the 0.499 — 0.001 in. dimension shown in cut view in upper left hand corner of drg. Finish mill the ammunition tray pad to the 3.687 — 0.005 in. dimension and the top of the two 1 in. diam. bosses to the 0.930 + 0.01 dimension. Use Standard 24 in. rotary table.

INSPECT

17. Finish mill the two notches in ammunition tray pad to the 5.437 + 0.005 in. and the 5.625 + 0.005 in. dimensions from center of trunnion bores and the 1.250 — 0.005 and the 2.625 + 0.005 in. dimensions.

18. Finish slot the 0.500 + 0.003 keyway.

19. Remove burrs and sharp edges.

INSPECT

20. Rough and finish straddle mill the 1½ in. bosses to the 0.812 — 0.005 in. thickness. Use Standard 8 in. dia. alternate angle cutters.

21. Remove burrs.

INSPECT



One of the more extensively jigged parts on this tank is the 37-mm. gun mount yoke which is a heat-treated alloy steel casting with Brinnel hardness of 235-260. Since this part is of rather complicated structure and has a comparatively thin cross-section for purposes of weight saving, special care must be exercised in the machining operations. The casting is first set up in the fixture shown here. Three locating pads are finish milled after the casting has been properly centered by means of the targets. Care in performing this operation will avoid difficulties in the succeeding machining operations. All castings that do not target are returned for restraightening

22. Rough and finish straddle mill the trunnion faces to the 5.000 ± 0.002 and 0.750 − 0.005 in. dimensions at the 1.626 + 0.001 dia. cross bore. Use Standard 8 in. dia. alternate angle cutters.

INSPECT

23. Rough and finish mill the trunnion bearing cap faces and the 1.875 + 0.001 in. keyway of the 1.626 + 0.001 in. dia. cross bore.

INSPECT

24. Rough and finish mill the face of pad projecting below the 1.626 + 0.001 in. to the 5.000 + 0.007 in. dim. shown at bottom of right hand view. Use Standard 8 in. dia. cutter.

INSPECT

25. Mill the 20° angular stop pad to the 5 9/16 in. dim.

26. Remove all burrs and sharp edges and file the 3 32 x 45° chamfer in notches.

INSPECT

27. Tap, drill four 7 16-2ONF-4 tap holes. Tap drill two ½-13NC-3 holes.

28. Tap drill four ⅜-24NF-4 tap holes.

29. Drill and ream the 0.250 + 0.001 dia. hole.

30. Drill two No. 12 dia. holes in end of the 0.189 + 0.003 × 7/16 in. slot.

31. Tap four 7/16-NF-4 tapped holes and tap two ½-13NC-3 tapped holes.

32. Tap four ⅜-24NF-4 tapped holes. *Note: The No. 4 fit of tapped holes must be held for studs.*

INSPECT

33. Finish mill the 0.189 + 0.003 × 7/16 in. slot.

34. Remove all burrs and sharp edges. Use hand reamer in the 0.250 + 0.001 in. dia. hole.

INSPECT

35. Assemble studs and caps.

INSPECT

36. Drill and ream the 1.250 + 0.001 in. trunnion diameters, the 1.250 + 0.002 in. pinion diameters and the 1.626 + 0.001 in. trunnion diameters. Tap drill two 5 16-24NF-2 holes. Drill and ream the 0.250 + 0.005, one 0.687 + 0.0005 dia. hole and drill one ⅝ in. dia. hole.

INSPECT

37. Disassemble caps and nuts for finish machining and remove burrs from yoke and cap bores.

38. Drill, ream and spotface four oil holes in trunnion bearings. Drill the 0.257 (F) dia. hole.

39. Tap two 5/16-24NF-2 tapped holes in ¾ x 3⅛ in. pad on left hand side of yoke.

40. Spotface both sides of the 0.257 (F) dia. hole.

INSPECT

41. Mill off the temporary locating pad from the 1 in. diam. boss on left hand side.

42. Mill off the temporary locating foot.

INSPECT

43. Reassemble caps to proper markings on yoke.

44. Hand form radii in the 1.250 + 0.001 dia. bore. Hand form radii in the 1.626 + 0.001 dia. bores.

45. Remove burrs and sharp edges. File smooth where locating lugs were milled off.

Cast Alloy Steel Parts



The part is then moved to a horizontal milling machine and mounted on the locating pads in the fixture shown here. The outside surfaces are rough milled at this point using standard milling cutters

Internal faces are milled on another horizontal milling machine in the fixture shown here. Note the set block at the left hand side of the fixture, the operator sets cutter using 0.01 in feeler gage





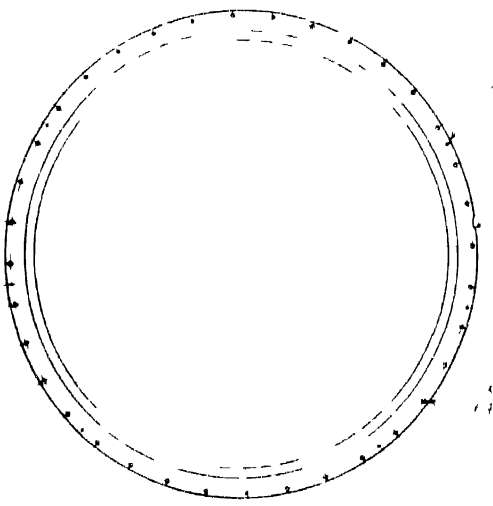
Trunnion bearings are straddle milled in a duplex milling machine while being supported at the proper angle in the jig so that a straight in feed can be used without having any projections interfere with the high-speed steel cutters

Final drilling and reaming operations are performed in a radial drill using the rotating jig in two positions as shown in the two accompanying illustrations Soluble cutting oil is used for the drilling operations and sulphur base oils for the tapping operations. High-speed steel drills and reamers are used The trunnion bearing face on the casting is wider than the bearing cap The ledge thus formed on the inside of the yoke casting serves as a locating pad and insures that holes will be reamed and drilled exactly on the parting line center The temporary locating pads and feet are milled off as the final operation

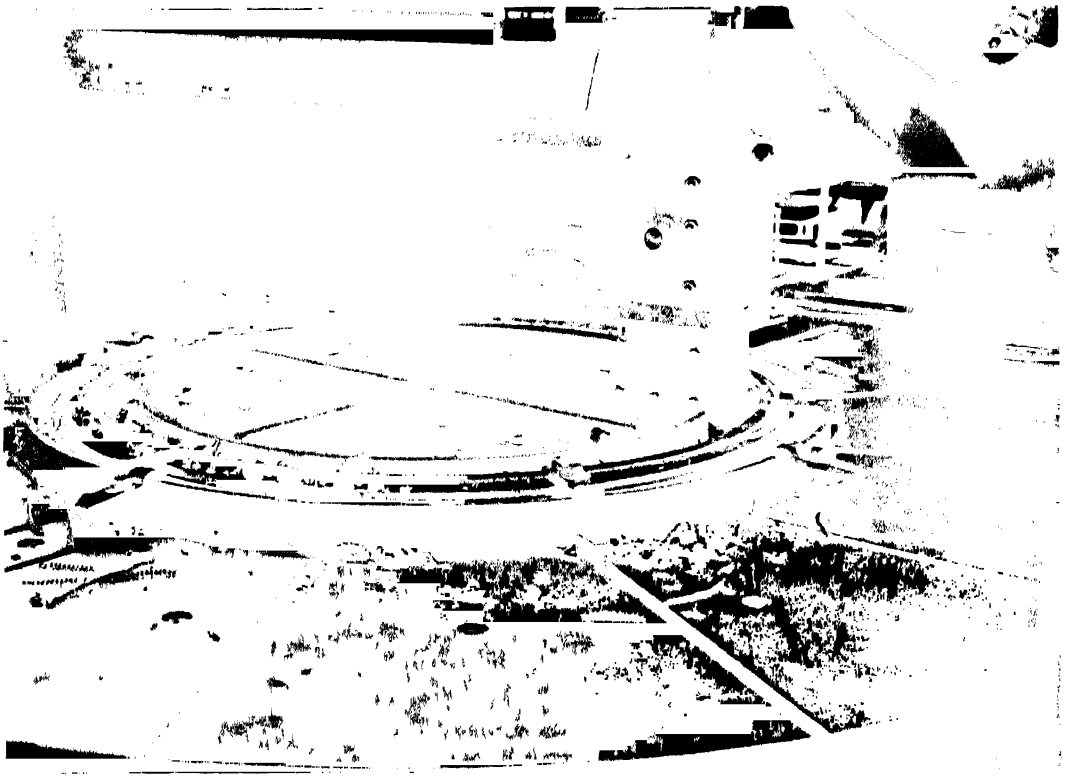


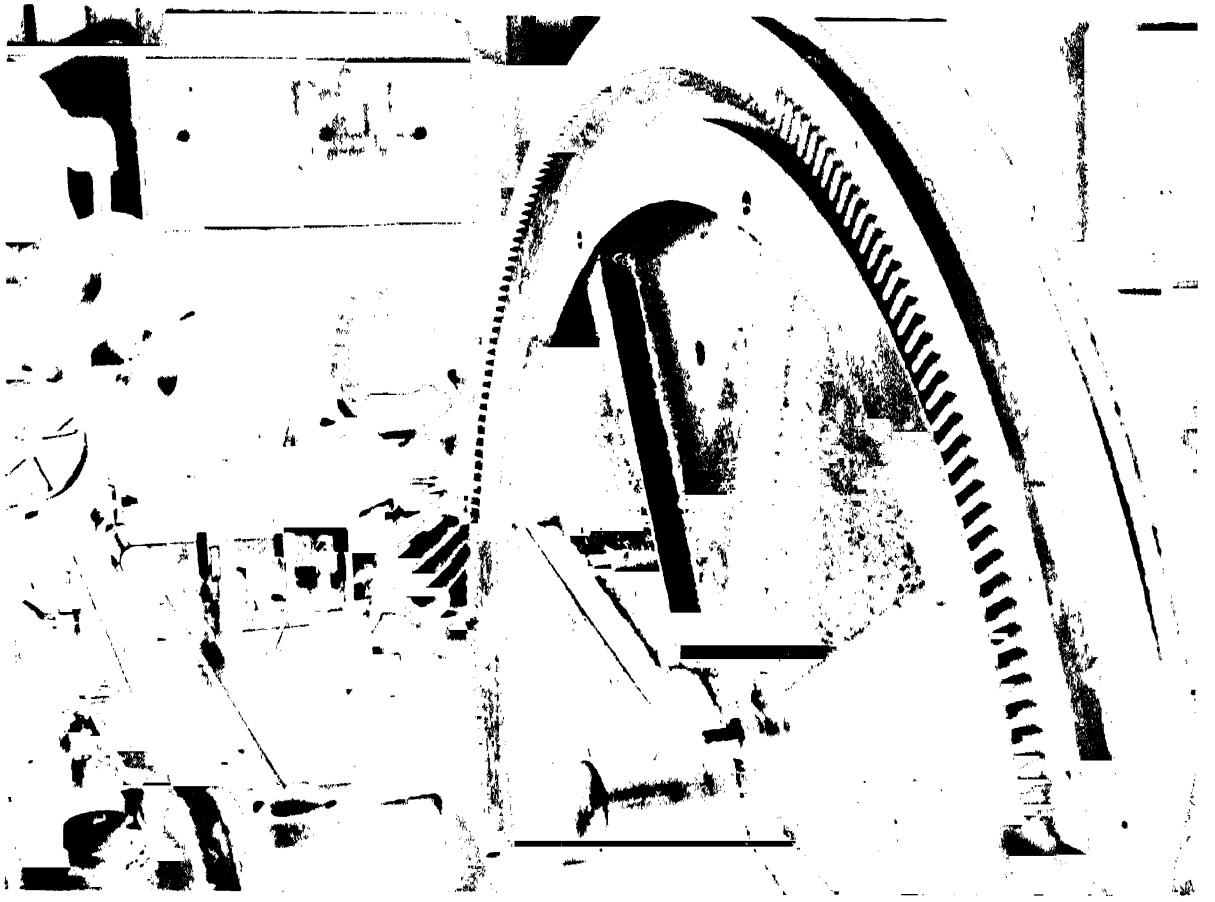


Chromium-Molybdenum Steel



The turret base ring having the approximate cross section shown in sketch is a one piece forging of SAE 4140 steel of approximately 51 in. diameter having a Brinnel hardness of 255 to 295. It is first rough turned and faced on top side and gear side in a Gisholt machine and then finish turned as shown here in a Cincinnati Hydromill. Feed downward is 0.010 in., table speed is 1.57 r.p.m. Rex XX tools are used for heavy cuts, high speed molybdenum cutting tools for light finish cuts. The ring which is of comparatively thin section is clamped in the heavy cast fixture. General tolerances on this ring are minus 0.005 in. After holes have been drilled and tapped in the ring it is ready for the final operation of cutting the teeth.





Teeth on the gear ring are cut in a bevel gear generator using four high-speed tools, a narrow one for the first plunge cut, a wider one for a second plunge cut, a finishing tool for the bottom of the tooth, a finishing tool for the top of the tooth. This Fellows stub tooth gear has 265 teeth, 53 in. pitch diameter, 1 in. face, and is made to a tolerance of 0.005 in. backlash.

Operation Sheet for: GEAR RING

MATERIAL: Rings forged without welds, chrome-molybdenum steel, normalized, annealed, heat-treated to Brinell hardness 255-285.

1. Rough turn and face top side.
2. Rough turn, bore and face gear side.
3. Finish turn the diameter holding it to 51.000–0.005 in. and the 0.855 in. face. Turn the 15° face of roller pad. *Note: The 51.000–0.005 diameter is for fixture purpose.*
4. Finish turn and face gear side. Finish turn the 35° face and the 1.125–0.005.

   INSPECT
5. Drill all holes for ⅜ 16-NC-2 tap and the nine ¼ 20NC 2 holes.
6. Tap every other ⅜ 16 NC 2 hole and tap all the ¼ 20NC 2 holes
7. Remove burrs

   INSPECT
8. Mill the 1 1 16 radius 5 16 in. deep and remove burrs.

   INSPECT
9. Cut teeth.
10. Remove sharp edges from teeth

    INSPECT
11. Grease to prevent rust.

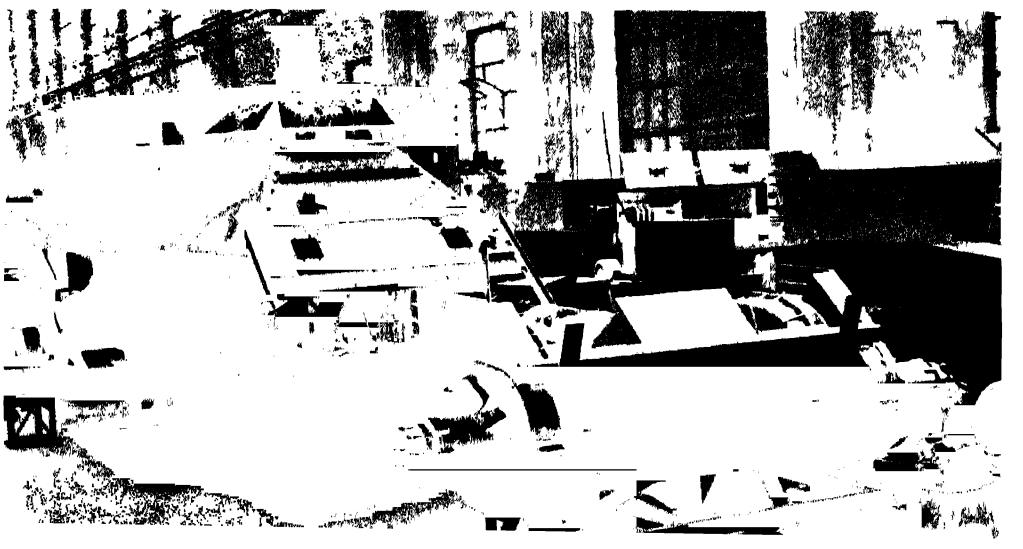
Tank Assembly



Tank turrets as well as the hulls primarily an assembly of flat armor plate and structural steel, are assembled by riveting in production line fashion Rivet holes up to $\frac{5}{8}$ in diameter are drilled with a $\frac{1}{64}$ in clearance instead of $\frac{1}{16}$ in common in riveting practice The rivet holes in the mating part are drilled $\frac{1}{32}$ in undersize and reamed on assembly to proper size and location with a bridge reamer As a further precaution and to insure that the rivet holes are properly filled, a special technique is used in heating the rivets in the gas furnaces which are spaced at convenient intervals along the production line

The arrangement for placing the rivets in the furnace is shown schematically By placing the rivets as shown the necessary gradation in heat for best driving from end to end is achieved Approximately 2 100 F is the temperature at which the furnaces operate If temperature is less than that the rivets won't fill if more they will scale The rivets must be worked only while the color is in them Otherwise they will not fit tightly On larger assemblies standard riveting hammers are used large stationary squeezers rivet sub assemblies

Further along the assembly line internal bracing is being welded inside of the hull A dummy structure is used to simulate the transmission shown in the foreground while the hull is under construction The complete transmission with its cast armor plate cover is purchased as one assembly from an outside manufacturer Note the structural steel legs' and lifting brackets still attached to the front armor plate, which simplify the job of handling this large and heavy part



Tap Standards—II

A STANDARD for cut and ground thread taps has been approved by the American Standards Association. It includes definitions, markings, working tolerances, as well as thread and general dimensions of American National Form Thread for hand taps, machine screw taps, tapper taps, nut taps, pulley taps, boiler taps, mud or washout hole taps, staybolt taps, pipe taps, combined pipe taps and drill. Markings and definitions, in addition to thread limits for fractional size taps, were published previously (AM Vol 84, pages 679 and 681). Thread limits for additional types and sizes of taps are presented herewith.

AMERICAN NATIONAL FORM THREAD LIMITS

Taper pipe taps—Cut and ground thread

Nominal Size	Threads per Inch, NPT	Gage Measurement			Lead Tolerance per Inch of Thread, Plus or Minus		Angle Tolerance			Taper per Foot Plus or Minus	
		Projection, Inches	Tolerance, Plus or Minus				Half Angle Plus or Minus		Full Angle		
			Cut Thread	Ground Thread	Cut Thread	Ground Thread	Cut Thread	Ground Thread	Cut Thread	Cut Thread	Ground Thread
1/8	27	0.312	1/16	1/16	0.003	0.0005	45	30	68	1/16	1
1/4	18	0.459	1/16	1/16	0.003	0.0005	45	30	68	1/16	1/32
3/8	18	0.454	1/16	1/16	0.003	0.0005	45	30	68	1/16	1/32
1/2	14	0.579	1/16	1/16	0.003	0.0005	45	30	68	1/16	1/32
3/4	14	0.565	1/16	1/16	0.003	0.0005	45	30	68	1/16	1/32
1	11 1/2	0.678	3/32	3/32	0.003	0.0005	45	30	68	1/16	1/32
1 1/4	11 1/2	0.686	3/32	3/32	0.003	0.0005	45	30	68	1/16	1/32
1 1/2	11 1/2	0.699	3/32	3/32	0.003	0.0005	45	30	68	1/16	1/32
2	11 1/2	0.667	3/32	3/32	0.003	0.0005	45	30	68	1/16	1/32
2 1/2	8	0.925	3/32	3/32	0.003	0.0005	40	25	60	1/16	1/32
3	8	0.925	3/32	3/32	0.003	0.0005	40	25	60	1/16	1/32
3 1/2	8	0.938	1/8	1/8	0.003	0.0005	40	25	60	1/16	1/32
4	8	0.950	1/8	1/8	0.003	0.0005	40	25	60	1/16	1/32

All dimensions are given in inches.

LEAD TOLERANCE. For cut thread taps a maximum lead error of plus or minus 0.003 in. in one inch of thread is permitted and for ground thread taps a maximum lead error of plus or minus 0.0005 in. in one inch of thread is permitted.

[1] Distance that the small end of tap projects through American Standard Pipe Thread Ring Gage (See ASA B2.)

Straight pipe taps—Ground thread

AMERICAN STANDARD

Nominal Size	Threads per Inch, NPS	Major Diameter				Pitch Diameter		
		Basic	Min	Max	Pipe[1] Gage	Basic	Min	Max
1/8	27	0.4044	0.4031	0.4041	0.3994	0.3748	0.3753	0.3763
1/4	18	0.5343	0.5321	0.5331	0.5269	0.4899	0.4904	0.4914
3/8	18	0.6714	0.6692	0.6702	0.6610	0.6270	0.6275	0.6285
1/2	14	0.8356	0.8325	0.8335	0.8260	0.7784	0.7789	0.7799
3/4	14	1.0460	1.0430	1.0440	1.0364	0.9889	0.9894	0.9904
1	11 1/2	1.3082	1.3018	1.3063	1.2966	1.2386	1.2396	1.2407

[1] See column 5, Table 57, NBSTC 1933 report.

All American Standard ground thread straight pipe taps made to above limits should produce holes which will accept a basic straight pipe gage.

Straight pipe taps—Cut thread

AMERICAN STANDARD

Nominal Size	Threads per Inch NPS	Major Diameter			Pitch Diameter		
		Basic	Min	Max	Basic	Min	Max
1/8	27	0.4044	0.4011	0.4041	0.3748	0.3733	0.3763
1/4	18	0.5343	0.5301	0.5331	0.4899	0.4884	0.4914
3/8	18	0.6714	0.6670	0.6705	0.6270	0.6253	0.6288
1/2	14	0.8356	0.8303	0.8338	0.7784	0.7767	0.7802
3/4	14	1.0460	1.0405	1.0445	0.9889	0.9869	0.9909
1	11 1/2	1.3082	1.3018	1.3058	1.2386	1.2366	1.2406
1 1/4	11 1/2	1.6530	1.6463	1.6508	1.5834	1.5811	1.5856
1 1/2	11 1/2	1.8919	1.8853	1.8898	1.8223	1.8201	1.8246
2	11 1/2	2.3658	2.3590	2.3640	2.2963	2.2938	2.2988

GREASE CUP FITTING

Nominal Size	Threads per Inch, Grease	Major Diameter			Pitch Diameter		
		Basic	Min	Max	Basic	Min	Max
1/8	27	0.4044	0.3929	0.3944	0.3748	0.3690	0.3700
1/4	18	0.5343	0.5202	0.5217	0.4899	0.4820	0.4830
3/8	18	0.6714	0.6572	0.6587	0.6270	0.6190	0.6200
1/2	14	0.8356	0.8202	0.8217	0.7784	0.7680	0.7695

All dimensions are given in inches.

LEAD TOLERANCE. A maximum lead error of plus or minus 0.0005 in. in one inch of thread is permitted.

ANGLE TOLERANCE.

Threads per Inch	Error in Half Angle
11 1/2 to 27 incl	30 min plus or minus

MARKING. In addition to regular marking grease cup fitting taps will be marked NPSG.

GREASE CUP FITTING

Nominal Size	Threads per Inch, Grease	Major Diameter			Pitch Diameter		
		Basic	Min	Max	Basic	Min	Max
1/8	27	0.4044	0.3924	0.3944	0.3748	0.3680	0.3700
1/4	18	0.5343	0.5197	0.5217	0.4899	0.4810	0.4830
3/8	18	0.6714	0.6567	0.6587	0.6270	0.6180	0.6200
1/2	14	0.8356	0.8192	0.8217	0.7784	0.7670	0.7695

All dimensions are given in inches.

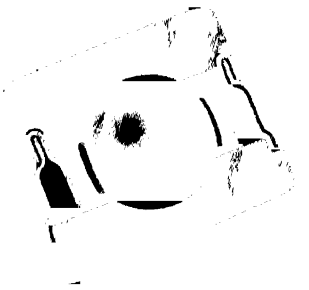
LEAD TOLERANCE. A maximum lead error of plus 0.003 in. in one inch of thread is permitted.

ANGLE TOLERANCE.

Threads per Inch	Error in Half Angle	Error in Full Angle
11 1/2 to 27 incl	45 min plus or minus	68 min

MARKING. In addition to regular marking, grease cup fitting taps marked NPSG.

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NEW DEPARTURE - DIVISION OF GENERAL MOTORS - BRISTOL, CONNECTICUT - DETROIT - CHICAGO

Tap Standards—II

AMERICAN NATIONAL FORM THREAD LIMITS

Machine screw taps—Cut thread

Screw Gage Number	Threads per Inch			Major Diameter			Pitch Diameter		
	NC	NF	NS	Basic	Min	Max	Basic	Min	Max
0		80		0.0600	0.0609	0.0624	0.0519	0.0521	0.0531
1			56	0.0730	0.0742	0.0757	0.0614	0.0616	0.0626
1	64			0.0730	0.0740	0.0755	0.0629	0.0631	0.0641
1		72		0.0730	0.0740	0.0755	0.0640	0.0642	0.0652
2	56			0.0860	0.0872	0.0887	0.0744	0.0748	0.0756
2		64		0.0860	0.0870	0.0885	0.0759	0.0761	0.0771
3	48			0.0990	0.1003	0.1018	0.0855	0.0857	0.0867
3		56		0.0990	0.1002	0.1017	0.0874	0.0876	0.0886
4			32	0.1120	0.1142	0.1162	0.0917	0.0922	0.0937
4			36	0.1120	0.1137	0.1157	0.0940	0.0942	0.0957
4	40			0.1120	0.1136	0.1156	0.0958	0.0960	0.0975
4		48		0.1120	0.1133	0.1153	0.0985	0.0987	0.1002
5	40			0.1250	0.1266	0.1286	0.1088	0.1090	0.1105
5		44		0.1250	0.1264	0.1284	0.1102	0.1104	0.1119
6	32			0.1380	0.1402	0.1422	0.1177	0.1182	0.1197
6			36	0.1380	0.1397	0.1417	0.1200	0.1202	0.1217
6		40		0.1380	0.1396	0.1416	0.1218	0.1220	0.1235
8	32			0.1640	0.1662	0.1682	0.1437	0.1442	0.1457
8		36		0.1640	0.1657	0.1677	0.1460	0.1462	0.1477
8			40	0.1640	0.1656	0.1676	0.1478	0.1480	0.1495
10	24			0.1900	0.1928	0.1948	0.1629	0.1634	0.1649
10			30	0.1900	0.1923	0.1943	0.1681	0.1689	0.1704
10		32		0.1900	0.1922	0.1942	0.1697	0.1702	0.1717
12	24			0.2160	0.2188	0.2208	0.1889	0.1894	0.1909
12		28		0.2160	0.2184	0.2204	0.1928	0.1933	0.1948
12			32	0.2160	0.2182	0.2202	0.1957	0.1962	0.1977
14			20	0.2420	0.2452	0.2477	0.2095	0.2100	0.2120
14			24	0.2120	0.2448	0.2473	0.2149	0.2154	0.2174

All dimensions are given in inches

LEAD TOLERANCE. A maximum lead error of plus or minus 0.003 in. in one inch of thread is permitted.

ANGLE TOLERANCE

Threads per Inch	Error in Half Angle	Error in Full Angle
20 to 28 incl.	45 min plus or minus	68 min
30 and finer	60 min plus or minus	90 min

Straight boiler and staybolt taps—Cut thread

Size	Threads per Inch, NF	Major Diameter			Pitch Diameter		
		Basic	Min	Max	Basic	Min	Max
1/2	12	0.5000	0.5010	0.5040	0.4459	0.4464	0.4489
9/16	12	0.5625	0.5635	0.5665	0.5084	0.5089	0.5114
5/8	12	0.6250	0.6260	0.6290	0.5709	0.5714	0.5739
11/16	12	0.6875	0.6885	0.6925	0.6334	0.6339	0.6369
3/4	12	0.7500	0.7510	0.7550	0.6959	0.6964	0.6994
13/16	12	0.8125	0.8135	0.8175	0.7584	0.7589	0.7619
7/8	12	0.8750	0.8760	0.8800	0.8209	0.8214	0.8244
15/16	12	0.9375	0.9385	0.9425	0.8834	0.8839	0.8869
1	12	1.0000	1.0010	1.0050	0.9459	0.9464	0.9494
1 1/16	12	1.0625	1.0635	1.0675	1.0084	1.0089	1.0119
1 1/8	12	1.1250	1.1265	1.1310	1.0709	1.0714	1.0749
1 3/16	12	1.1875	1.1890	1.1935	1.1334	1.1339	1.1374
1 1/4	12	1.2500	1.2515	1.2560	1.1959	1.1964	1.1999
1 5/16	12	1.3125	1.3140	1.3185	1.2584	1.2589	1.2624
1 3/8	12	1.3750	1.3765	1.3810	1.3209	1.3214	1.3249
1 7/16	12	1.4375	1.4390	1.4435	1.3834	1.3839	1.3874
1 1/2	12	1.5000	1.5015	1.5060	1.4459	1.4464	1.4499

All dimensions are given in inches

LEAD TOLERANCE. A maximum lead error of plus or minus 0.003 in. in one inch of thread is permitted.

ANGLE TOLERANCE

Threads per Inch	Error in Half Angle	Error in full Angle
12	45 min plus or minus	68 min plus or minus

Machine screw taps—Ground thread

COMMERCIAL GROUND

Screw Gage Number	Threads per Inch			Major Diameter			Pitch Diameter		
	NC	NF	NS	Basic	Min	Max	Basic	Min	Max
3	48			0.0990	0.1000	0.1010	0.0855	0.0857	0.0867
3		56		0.0990	0.0995	0.1005	0.0874	0.0876	0.0886
4			36	0.1120	0.1135	0.1145	0.0940	0.0942	0.0952
4	40			0.1120	0.1135	0.1145	0.0958	0.0960	0.0970
4		48		0.1120	0.1130	0.1140	0.0985	0.0987	0.0997
5	40			0.1250	0.1265	0.1275	0.1088	0.1090	0.1100
5		44		0.1250	0.1260	0.1270	0.1102	0.1104	0.1114
6	32			0.1380	0.1400	0.1410	0.1177	0.1182	0.1192
6		40		0.1380	0.1395	0.1405	0.1218	0.1220	0.1230
8	32			0.1640	0.1660	0.1670	0.1437	0.1442	0.1452
8		36		0.1640	0.1655	0.1665	0.1460	0.1462	0.1472
10	24			0.1900	0.1930	0.1940	0.1629	0.1634	0.1644
10		32		0.1900	0.1920	0.1930	0.1697	0.1702	0.1712
12	24			0.2160	0.2190	0.2200	0.1889	0.1894	0.1904
12		28		0.2160	0.2185	0.2195	0.1928	0.1933	0.1943
14			20	0.2120	0.2460	0.2470	0.2095	0.2100	0.2110
14			24	0.2120	0.2450	0.2460	0.2149	0.2154	0.2164

PRECISION GROUND

Screw Gage Number	Threads per Inch			Major Diameter			Pitch Diameter		
	NC	NF	NS	Basic	Min	Max	Basic	Min	Max
0		80		0.0600	0.0605	0.0615	0.0519	0.0519	0.0524
1			56	0.0730	0.0735	0.0745	0.0614	0.0614	0.0619
1	64			0.0730	0.0735	0.0745	0.0629	0.0629	0.0634
1		72		0.0730	0.0735	0.0745	0.0640	0.0640	0.0645
2	56			0.0860	0.0865	0.0875	0.0744	0.0744	0.0749
2		64		0.0860	0.0865	0.0875	0.0759	0.0759	0.0764
3	48			0.0990	0.1000	0.1010	0.0855	0.0855	0.0860
3		56		0.0990	0.0995	0.1005	0.0874	0.0874	0.0879
4			36	0.1120	0.1135	0.1145	0.0940	0.0940	0.0945
4	40			0.1120	0.1135	0.1145	0.0958	0.0958	0.0963
4		48		0.1120	0.1130	0.1140	0.0985	0.0985	0.0990
5	40			0.1250	0.1265	0.1275	0.1088	0.1088	0.1093
5		44		0.1250	0.1260	0.1270	0.1102	0.1102	0.1107
6	32			0.1380	0.1400	0.1410	0.1177	0.1177	0.1182
6		40		0.1380	0.1395	0.1405	0.1218	0.1218	0.1223
8	32			0.1610	0.1660	0.1670	0.1437	0.1437	0.1442
8		36		0.1640	0.1655	0.1665	0.1460	0.1460	0.1465
10	24			0.1900	0.1930	0.1910	0.1629	0.1629	0.1634
10		32		0.1900	0.1920	0.1930	0.1697	0.1697	0.1702
12	24			0.2160	0.2190	0.2200	0.1889	0.1889	0.1894
12		28		0.2160	0.2185	0.2195	0.1928	0.1928	0.1933

All dimensions are given in inches

LEAD TOLERANCE. A maximum lead error of plus or minus 0.0005 in. in one inch of thread is permitted.

ANGLE TOLERANCE

Threads per Inch	Error in Half Angle
20 to 80 incl.	30 min plus or minus

Bent-shank tapper taps—Cut thread

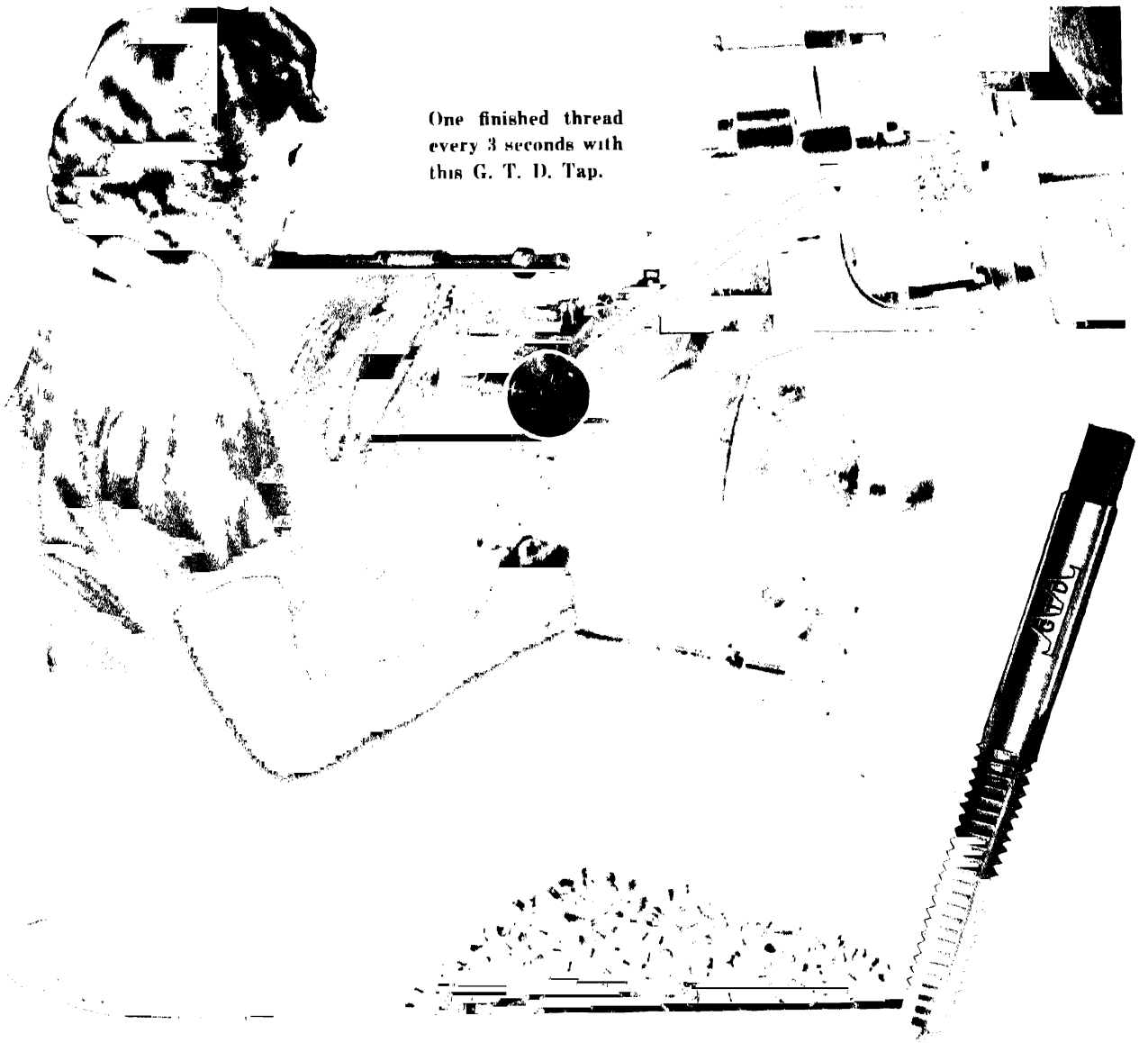
Size	Threads per Inch, NF	Major Diameter			Pitch Diameter		
		Basic	Min	Max	Basic	Min	Max
1/4	28	0.2500	0.2519	0.2544	0.2268	0.2263	0.2283
5/16	24	0.3125	0.3148	0.3173	0.2854	0.2849	0.2869
3/8	24	0.3750	0.3768	0.3793	0.3479	0.3469	0.3489
7/16	20	0.4375	0.4392	0.4422	0.4050	0.4035	0.4060
1/2	20	0.5000	0.5017	0.5047	0.4675	0.4660	0.4685
9/16	18	0.5625	0.5845	0.5675	0.5264	0.5249	0.5274
5/8	18	0.6250	0.6270	0.6300	0.5889	0.5874	0.5899
3/4	16	0.7500	0.7519	0.7559	0.7094	0.7071	0.7104

All dimensions are given in inches

LEAD TOLERANCE. A maximum lead error of plus or minus 0.003 in. in one inch of thread is permitted.

ANGLE TOLERANCE

Threads per Inch	Error in Half Angle	Error in Full Angle
16 to 28 incl.	45 min plus or minus	68 min plus or minus



MORE PRODUCTION

WITH G. T. D. HIGH SPEED TAPS

Do you want faster production? This company did on these heavy duty cast brass elbows. They got it, too, when they adopted G. T. D. Greenfield High Speed Ground Thread 7/16-24 Taps. Average production was stepped up from 1050 to 1220 per hour, a 16% increase. And production per tap went from 9,000 to 12,000, up 33⅓%. These increases represented clear savings because they used the same machine, and even the same cutting lubricant.

G. T. D. Greenfield solicits the opportunity to make equally good in your plant. Our standard and special threading tools are backed by the accumulated experience of over 75 years, all of which is at your disposal. Get in touch with your local distributor or with a G. T. D. Engineer.

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Priorities

PRIORITIES is a word which manufacturers dislike. It suggests government regulation and control of their business. It revives memories of painful headaches back in World War days. It engenders fears of further regimentation of industry in a world rapidly becoming undemocratic.

Yet industrialists realize that in a time of grave emergency, such as the present, nothing should stand in the way of the Army and Navy and munitions makers getting machine tools and other defense materials ahead of other buyers.

If government-imposed priorities are the only means of seeing that defense industries get what they need as quickly as possible, let's have such priorities. But there is reason to believe that voluntary cooperation may work and that legal priorities may be unnecessary.

That appears to be the line of thought of the National Defense Advisory Commission, the Army and the Navy in adopting a system of preference ratings on defense contracts. The system, in essence, sets up preferred deliveries on equipment and materials for these contracts and depends for its enforcement upon the voluntary cooperation of industry. As long as delivery dates are met, adjustments of production schedules are to be left to the manufacturers.

At first, preference ratings probably will be applied more extensively in machine tools than anywhere else. If they work there, defense officials will be favorably disposed toward using them in other branches of industry.

How the system will function will depend upon teamwork. It is clear that a recalcitrant attitude on the part of a few may easily spoil the commendable conduct of the overwhelming majority. That is why it is so important that every member of the industry do his part.

Says the National Defense Advisory Commission, "Continuance of the proposed voluntary system depends on complete voluntary cooperation of government and industry. . . . The Commission favors continuance . . . *until it appears that more authoritative measures are required.*"

Recent history of the machine tool industry gives hope that the preference rating system has a good chance of success. Builders have sharply increased their output and plant capacity without losing their heads. When aircraft engine makers got in a bad jam and asked for help, the machine tool people saw that machines reached the right spot at the right time. When the Navy wanted plate planers in a hurry, a number of companies worked together to shorten delivery dates by months. The machine tool industry's defense committee has labored tirelessly to see that machines required the worst for defense purposes were produced and delivered the fastest.

While a solemn obligation rests on industry to see that the preference rating system operates efficiently, a like responsibility rests on Army and Navy officials to do first things first. Especially in machine tools, if these officials become unreasonable and expect equipment to be delivered to a specified point before it can be used, no good will be accomplished and an injustice will be done the manufacturers. Surely orders can be spaced out so that the government will benefit to the maximum from machine tool builders' output, and so that the builders in turn can do the best possible job.

If both parties to the defense program — the government and industry — will go at their tasks in a spirit of cooperation, of appreciation of each other's problems and of genuine patriotism, the country will be the winner.

Burnham Finney

GAGING BUSINESS

Machine tools totaling $600,000,000 needed for defense program. Most U. S. machines bought by British still being sent to England. Chrysler will build five tanks each 8-hour shift

An avalanche of defense orders is expected to descend on the metalworking industry in the next thirty days, assuring thousands of plants of the busiest winter in their history. Employment and payrolls will not rise sharply immediately, however, because the tooling up process prior to mass production will take many weeks, and in some cases months. One of the industry's main worries is the acute shortage of labor which looms ahead.

Machine Tools - With an estimated $600,000,000 of machine tools needed for the defense program in the next year and a half, machine tool builders are putting into effect at present an intensified system of voluntary priorities which applies not only to them, but also to sub-contractors. It is anticipated that this plan will make unnecessary government-imposed priorities. The voluntary system will give right-of-way to defense orders over all others. An impression abroad that the industry will not take any further business from companies making peacetime goods is incorrect. Actually, however, machine tool builders' plants are filled to overflowing with bookings for defense and for the British. The big influx of orders the past fortnight has shoved deliveries farther back. Whether the industry will have to expand its plant capacity much further is a moot question. Capacity now is 30 per cent greater than last September, most factories are working 20 out of 24 hours a day, and some companies have as many as 43 sub-contractors producing parts for them. If Army and Navy needs are spread out over the next 18 months, instead of concentrated in a much shorter period, the industry can meet specified deliveries without stretching plants beyond present capacities. Despite heavy bombings in England, the British are having most of the machine tools bought in this country shipped to England. Only a small percentage currently is going to Canada and to Australia or to U. S. plants with British contracts.

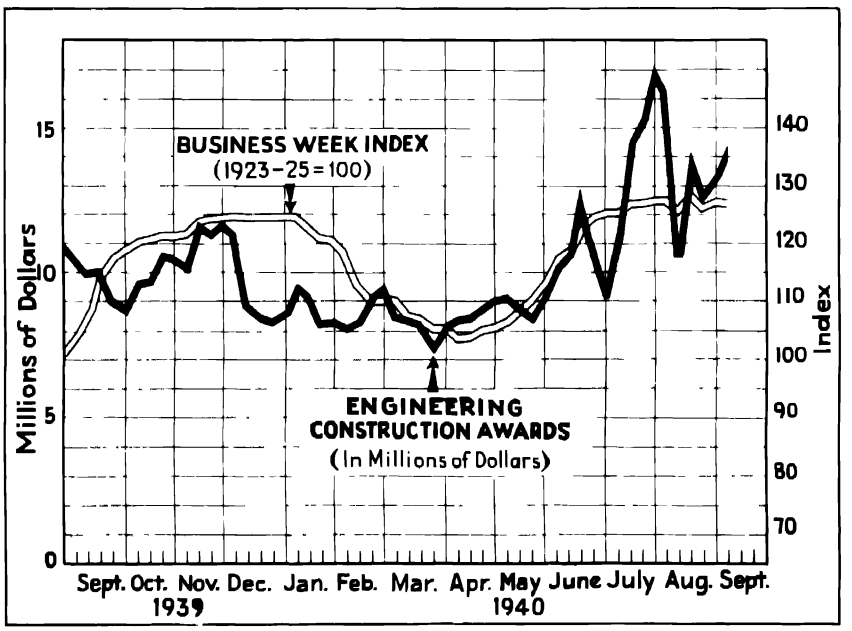
Munitions--Sites for 16 munitions plants have been selected by the Army and the money for them is available, but locations are not yet being divulged because of political pressure from disappointed communities. The Army is prepared to let huge munitions contracts almost immediately, now that the status of new plant amortization and taxes is being cleared up by Congressional legislation. Chrysler will build 1,000 tanks on its initial order at cost of $33,500 each. A subsequent order for 1,000 more tanks can be handled for $28,500 each. Production will be on a basis of five tanks per day on a single shift, for which 6,000 men will be needed. The British are still trying to arrange for production of 4,000 tanks in this country.

Aircraft—Airplane makers are in the midst of an expansion program which will virtually double their manufacturing space. With the placing of some 4,000 planes shortly by the government, backlogs will be close to $2,000,000,000. Present production is about 900 planes a month. It is understood most of the combat ships completed are going to the British. Allison Division of General Motors is said to be up to 130 motors a month and will touch 400 a month before the year is out. Within eight months Ford expects to be building Pratt & Whitney motors, the goal being one motor an hour.

Railroad Equipment—Freight car purchases in the final half of 1940 should touch 40,000 units. Over 11,000 cars were ordered in July and August, representing the best summer buying in over 10 years. Around 400 cars and 21 diesel-electric locomotives were bought in the first two weeks of September. Electro-Motive Corp. is adding 75,000 square feet to its floor space and currently is turning out about 20 diesel-electric locomotives a month. Pullman, American Locomotive and J. G. Brill have bid on gun carriages for the U. S. Army.

Farm Equipment– With farm income five per cent higher than last year, farm equipment sales should be $450,000,000 for 1940. Exports are running 30 per cent above last year, most of the gain being in tractor and tillage equipment. Production is mostly down to a single shift, though some plants are still working two shifts on tractor parts. Minneapolis Moline is erecting a new sheet metal and combine assembly plant to cost $300,000.

Steel—Output is above 90 per cent and is expected to stay there the remainder of the year. If the war continues, a scarcity of steel may develop next spring. Even should the war end, the defense program will keep consumption at a high rate. Steel inventories are relatively high, but not dangerously so in view of present broad industrial operations.



Voluntary System of Priorities Adopted For Machine Tools For Defense Contracts

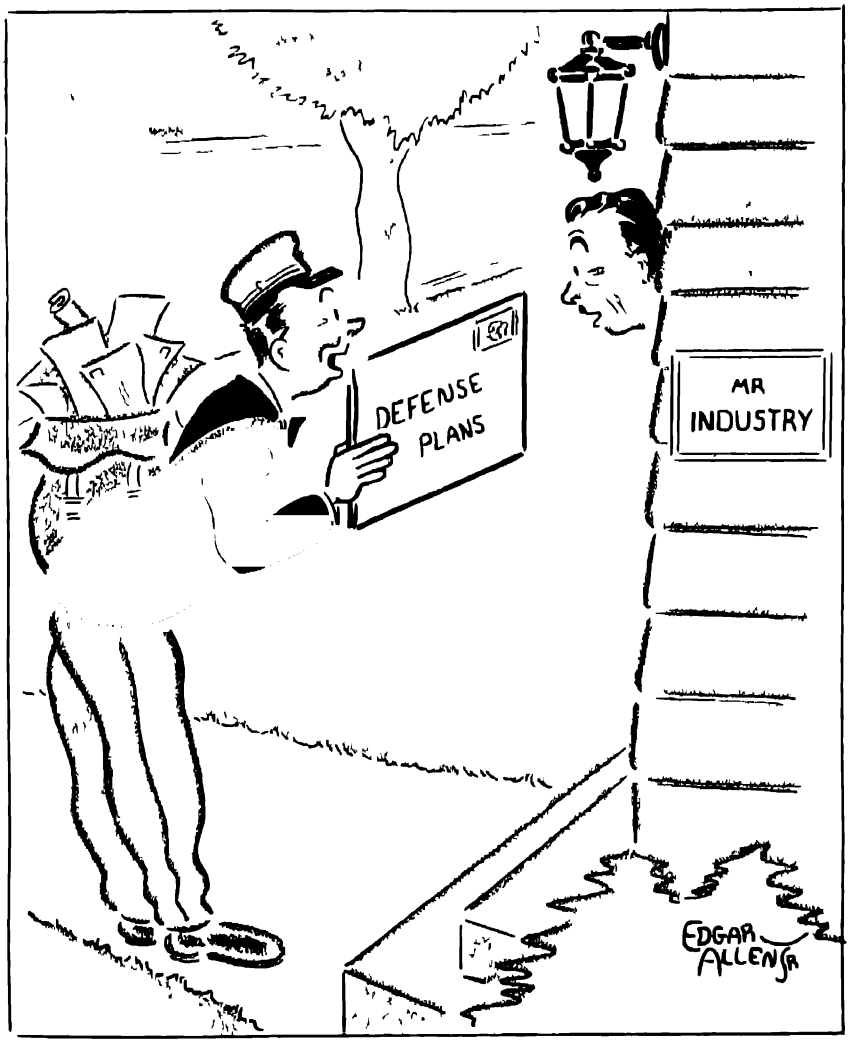
WASHINGTON—Preference classifications are to be given to all machine tool orders for the defense program and machine tool builders are being asked voluntarily to accept such ratings without the necessity of the government resorting to legally enforced priorities

General classifications to be employed are class AA reserved for future emergencies of exceptional nature, and class A consisting of such Army and Navy orders as require specially preferred treatment Each of these classifications will be subdivided as far as may be necessary For example, AA1, AA2 A A1, A2, etc In addition to the preference classification each government order will carry a desired delivery date and delivery date is the primary consideration

A high preference rating does not mean that work on or delivery of orders bearing a lower classification or orders for private account or for export should be delayed unless necessary to meet the delivery date on the order bearing a superior preference rating As long as delivery dates are met details of adjustment will be left primarily to the industry itself The Army Navy and Defense Commission will assist

Under supervision of the government contracting officer a prime contractor is authorized to extend the preference rating to his subcontractors including materials services, production machinery or equipment required for completion of the contract If the contractor's problem of getting equipment and supplies still is acute he should refer his case to the Priorities Committee of the Army and Navy Munitions Board Room 2010 Munitions Building, Washington Requests for preference ratings by the industry should be made to the Priorities Committee

The preference rating system follows the same procedure as if legal priorities had been invoked Its success depends on hearty cooperation by every manufacturer



"I hope it's an order, not an eviction notice."

FORGING CAPACITY EXPANDING

WASHINGTON—An expansion of private heavy forging capacity costing about $40,000,000 has been worked out between the Defense Commission and the steel industry The capacity is needed both for ship forgings as well as for big guns and shells Part of the cost will be met by government advances and part will be financed by the firms themselves In addition the government itself will increase its facilities for forging shafting at the South Charleston naval ordnance plant The Navy moreover will buy a 14 000-ton press and intensifier and several smaller presses to be installed in a steel company

Contracts for 200 Warships Completed; To Cost $3,861,053,321

WASHINGTON—A few hours after the President signed the five billion dollar supplemental defense appropriation the Navy completed contracts for nearly four billion dollars worth of warships—the whole 200 ships needed to complete the authorized 70 per cent expansion of the Navy and build a two-ocean fleet The appropriation bill provides the $183 000 000 needed to pay for this year's portion of the work, a substantial portion of this money will be spent for construction facilities at the private yards rather than for the ships themselves but it is hoped to have most of the keels down this year The new contracts call for 7 battleships 27 cruisers 8 aircraft carriers 115 destroyers and 43 submarines plus 1 repair ship All of the battleships 7 of the destroyers and 8 of the submarines will be built in Navy Yards, but the rest will be privately constructed The total cost of construction of these vessels is $3 861 053 321 which includes the cost of armor and armament and in the case of submarines also includes government-finished machinery

The contracts have been let as follows Newport News 4 aircraft carriers and 2 cruisers, Bethlehem Steel Co 4 aircraft carriers 10 cruisers and 34 destroyers, New York Shipbuilding Corp 10 cruisers Federal Shipbuilding & Drydock Co 5 cruisers and 17 destroyers Seattle Tacoma Shipbuilding Co 20 destroyers Consolidated Steel Corp Ltd Orange Texas 12 destroyers

Bath Iron Works Corp Bath Maine 11 destroyers, Electric Boat Co Groton Conn 25 submarines, Manitowoc Shipbuilding Co Manitowoc Wis 10 submarines, Los Angeles Shipbuilding & Drydock Co Los Angeles Calif 1 repair ship, Gulf Shipbuilding Corp Chickasaw Ala 4 destroyers All others are being built in government navy yards

KNUDSEN EXPECTS 3000 PLANES A MONTH BY 1942

2,200 engines a month is present output. Gigantic plant expansion aid increased production; many get RFC loans

WASHINGTON — Defense Commissioner Knudsen, on an inspection trip with Air Corps Chief Gen Arnold said the defense schedule calls for peak production of 3,000 planes per month by July, 1942, and by April of that year a total of 33 000 planes should have been built, of which 14 - 000 will have gone to Britain Of the 19,000 for the U S 60 per cent will be combat types, and the rest will be cargo transport, and trainer planes The present output of engines is 2 200 a month By July, 1941 this figure should be 3,500 per month

To prepare for this accelerated output the plane industry has been expanding plants, facilities and research equipment at a great speed during the past 12 months Much of the improvement has been accomplished with private funds However in recent months the government-financed Reconstruction Finance Corp has loaned millions of dollars to the aviation industry A summary of recent aircraft and engine plant expansion in progress or projected follows·

Packard Motor Company spending $30,000 000 of its own money plus $8 - 000,000 RFC loan for plant to produce 9,000 Rolls Royce engines, beginning in 10 months at 20 engines per month, increasing to 840 per month in 15 months from contract date Expect to employ 14,000 workers in addition to present 10,000 It is understood that Britain is furnishing some of the capital against future delivery of engines

$92,000,000 RFC Loan

Wright Aeronautical spending $92 - 000 000 RFC money for plant space which will increase capacity to 12 000 engines a year About $37 000 000 will go into a new 1 000 000 sq ft plant at Lockland Ohio which will employ 12 000 to 15,000 workers Some of the balance will go to subcontractors' plant increases One is Studebaker which will make Wright parts in expanded plant at South Bend and at Detroit About $2 000 000 of the RFC loan will go into the Curtiss propeller plant at Caldwell N J $8,000,000 will be spent for machine tools at Wright's plant in Cincinnati

Curtiss - Wright Corp, Buffalo spending $51 160 000 RFC money for new aircraft plants and equipment at Buffalo, Columbus Ohio and St Louis This includes $15 000 000 for labor and materials and $2 160 000 for machinery and equipment which will total $51 160,000

Douglas Aircraft Co spending $20,- 000 000 of private funds for expansion at Santa Monica a new plant at Long Beach small plant at El Segundo A total of 31,110,000 sq ft will double the company's present floor space

Pratt & Whitney (Division of United Aircraft) spending $15,000 000 of private funds to expand the East Hartford plant, double floor space of Vought-Sikorsky add another bay to Hamilton Standard Propeller Most construction contracts have been let and large machine tool purchases are under way The company already has spent $16 000 000 in the last 18 months for a new plant Employees have increased over same period from 5 000 to 15 000 To meet its Army-Navy quota P & W will license Ford Motor Co to build 1650 hp double row Wasp engines at $1 license fee per engine

Glenn L Martin Co spending $24 - 000 000 of private funds to increase floor space 1 000 000 ft to near 3 000 - 000 ft The company recently expanded its plant in record time of 77 days and claims to be the first to break ground in the defense program without waiting for amortization legislation It expects to have new space in production by New Year

Ford Will Build Plant

Ford Motor Company will build a new plant on the Rouge for production of Pratt & Whitney engines undoubtedly using private funds Equipment needs are being surveyed Ford is reported about ready to start production of his own liquid-cooled engine presumably based on the Rolls Royce design which he had in the works for months and finally dropped

Boeing Aircraft Co spending $10 - 500 000 RFC money for increased plant two thirds of it at Seattle and the remainder at Wichita where the company's Stearman plant produces primary trainers

Consolidated Aircraft Corporation spending $1 050 000 on an 82 per cent plant expansion The number of employees will increase from 9 600 men to 15 000 by Christmas

Aviation Manufacturing Corp spending $1 800,000 for a 4-year expansion program

Vultee Aircraft Inc recently took over Stinson Division of Aviation Manufacturing Corp has completed a new factory at Nashville, and is planning further expansion

Lockheed Aircraft Co spending $5,500,000 of its own money for expansion of its Vega Airplane Co plant in California

Beech Aircraft Corp· building a new plant at Wichita

Bellanca Aircraft Corp· planning to spend $1,000,000 for a new plant at

Exports of Machinery During July, 1940

	July 1940	June 1940	July 1939
Electrical Machinery and Apparatus	$8 890 619	$9 607 069	$8 088 227
Power generating machinery except automotive and electrical	1 [illegible] 051	2 126 581	1 154 815
Construction and conveying machinery	2 152 152	3 111 301	2 012 144
Mining well and pumping machinery	4 746 107	3 788 480	4 940 808
Power driven metal working machinery	14 906 312	18 564 300	9 [illegible] 876
Other metal working machinery	82 087	506 917	340 84
Textile machinery	937 061	1 043 [illegible]	620 100

Metal-Working Machinery

Engine lath	$[illegible] 930	$1 [illegible] 207	$[illegible] 4 411
Turret lathes	1 019 96	1 451 694	698 57
Other lathes	629 638	888 [illegible]	317 785
Vertical boring mills and chucking machines	307 944	509 499	638 747
Thread cutting and automatic screw machines	3 749	1 120 424	528 341
Knee and column type milling machines	587 325	907 [illegible]	628 809
Other milling machines	1 115 960	1 438 827	1 223 758
Gear cutting machines	484 344	598 420	331 371
Vertical drilling machines	142 756	261 353	106 908
Radial drilling machines	206 846	200 808	24 600
Other drilling machines	494 947	714 837	140 191
Planers and shapers	855 283	438 494	382 717
Surface grinding machines	167 122	298 060	283 903
External cylindrical grinding machines	399 939	437 110	209 248
Internal grinding machines	485 327	562 989	480 129
Tool grinding cutter grinding and universal grinding machines	354 798	406,839	283 034
Other metal-grinding machines and parts	909 173	748,398	174 756
Sheet and plate metal working machines and parts	1 850 366	714 319	353 550
Forging machinery and parts	917 907	763 117	301 374
Rolling mill machinery and parts	1 008 770	2 884 832	588 126
Molding machines	221 124	23 690	4 061
Other foundry equipment and parts	90 159	176 041	74 708
Other power-driven metal-working machinery and parts	1 976 694	1,723 787	829 356
Pneumatic portable tools	102 356	73 285	91 278
Other portable and hand or foot-operated metal working machines and parts	147 000	174 436	103,354
Chucks for machine tools	70 488	56 508	28,735
Milling cutters machine-operated threading dies and taps and similar machine operated metal cutting tools	107,030	106 649	51 058
Other metal-working machine tools and parts	156,213	188 039	66 418

Yonkers, N. Y. The company will build speed boats in addition to airplanes.

Bell Aircraft Corp.: doubling its space at Buffalo.

Brewster Aeronautical Corp.: enlarging plants at Newark, N. J., and on Long Island.

Grumman Aircraft and Engineering, Bethpage, Long Island: expanding its plant to fill a $7,000,000 order for Navy bombers.

Republic Aviation Corp.: increasing its total floor space from 218,000 to 850,000 square feet.

Fairchild Aviation: has tripled the space of its engine plant at Hagerstown, Md., and is said to be negotiating with RFC for a loan.

Bendix Aviation Co.: has a commitment for a $17,000,000 RFC loan for plant extension and additional machinery.

Fleetwings, Inc.: will spend $1,000,000 for a plant at Dallas, Texas.

New Plants Go Up in Far East; Germany Plans Two Subsidiaries

TOKYO—The Shoun Machine Tool Manufacturing Co., which recently raised its share capital to $585,000, has begun construction on a new plant at Ofuna, near Yokohama. The AEG concern of Germany (Allgemeine Elektricitatsgesellschaft) has completed arrangements for the establishment of two subsidiaries in the Far East. The proposed companies will produce electric and general machinery in competition with the existing plants.

Shell Production Problems Discussed At A.S.M.E. Meeting in Pittsburgh

PITTSBURGH — James L. Walsh, chairman of the A.S.M.E. committee on national defense, presided at a meeting on shell manufacture September 11 which was attended by almost 300 army ordnance officers, manufacturing representatives interested in shell production, and machine tool builders. It now tentatively is planned to hold a similar meeting in Cincinnati October 16 and 17.

Col. B. O. Lewis, asst. chief of ordnance, U. S. Army, said present plans call for providing complete equipment for 1,200,000 men, critical items for 800,000 additional men, including armament and bombs for 18,000 airplanes. Shell components probably will be made in scattered industrial plants, assembled in loading plants, operated by the Ordnance Department. Some improvising will be necessary to get the program under way rapidly.

Frederick G. Schranz, general manager, Baldwin-Southwark Division, Baldwin Locomotive Works, discussed hydraulic and mechanical methods of forging shell. Forging machine methods were described by J. H. Friedman, vice-president, National Machinery Co., who used motion pictures to illustrate his talk. He pointed out the striking similarity between the forging of automobile drag links and the forging of shell.

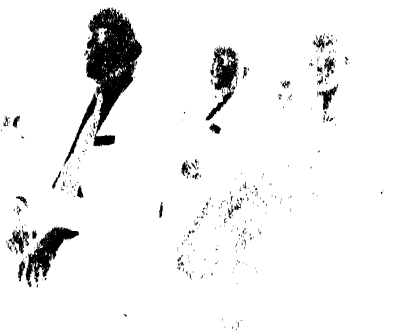
James Hopkins, of Salem Engineering Corp., outlined the process developed by Claude Witter for producing shells from forged blanks in what fundamentally is a seamless tube rolling machine. By this process a forged 75-mm. shell can be produced from a 16-lb. billet.

Lt. Col. A. B. Johnson, U. S. Army, office of the asst. secretary of war, pointed out that many million shells probably will be needed during the next year to meet U. S. Army and British requirements.

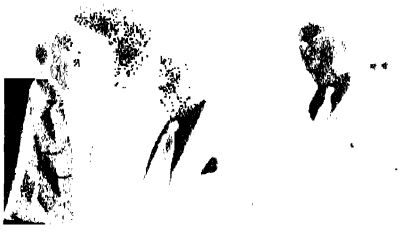
Col. E. C. Bomar, Capt. Alford and Charles Grazioso, of Frankford Arsenal, described methods now being used for machining shell, using a moving picture to show the machines and tools at work on a conveyorized shell line. Col. Bomar pointed out the advantages of using a finished forged bore, stating that it had been a boon to the machine line.

E. P. Blanchard, of the Bullard Co., pointed out some of the elements of design that make some foreign shells difficult to machine, and discussed differences in methods of machining used in this and other countries. He told the group that during 1938 more than half of the shells made in England were produced in German-made machines tooled with Widia.



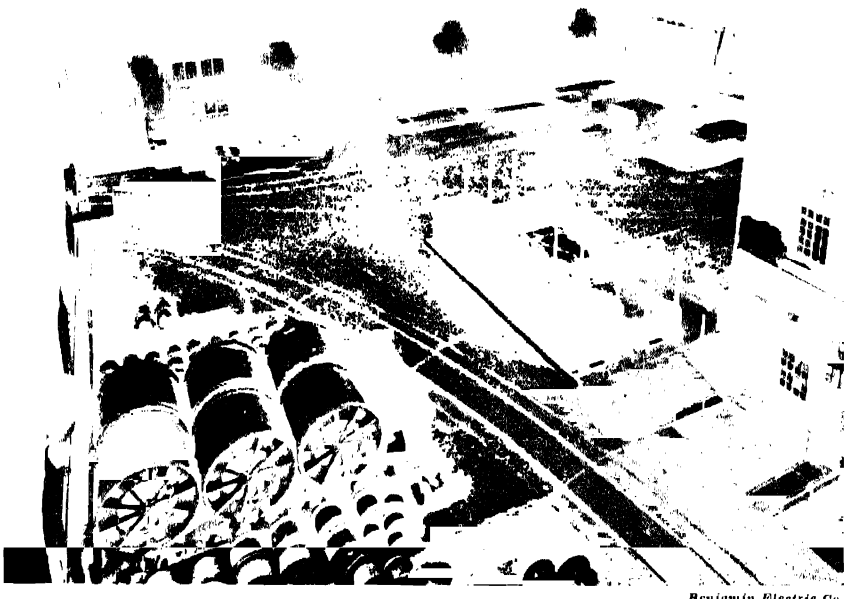


Above, J. H. Friedman, P. H. Miller, and James R. Longwell (left to right) listen to speaker at A.S.M.E. meeting in Pittsburgh



Attentive Listeners—*All those who attended the A.S.M.E. meeting found the comment on shell manufacture of great interest. Above, James L. Walsh, (right) chairman of the A.S.M.E. committee on defense, holds the attention of Col. E. C. Bomar (left) and Lt. Col. A. B. Johnson*

Above, E. P. Blanchard of Bullard Co. (left) talks to Carl Bintz of Wicks Bros. while Frederick G. Schranz listens to the proceedings



Benjamin Electric Co.

Floodlights Prevent Sabotage—*Industry is protecting itself against sabotage by the increased use of floodlights and the government has urged all public utilities to use this method of preventing damage. General yard lighting also facilitates night operations*

Japan May Nationalize Machine Tool Plants; Firms Make High Profit in Last Six Months

TOKYO—Bills relating to a large scale nationalization of the existing smaller machine tool building concerns, as a retaliatory measure to meet American restrictions on exports, are expected to be introduced in the coming session of the Diet. The draft bill is based on memoranda by Army and Navy leaders who are calling for increased supplies of precision gear cutters, dies, turret lathes, grinders, micrometers, graduators and calipers. Many of the smaller plants are handicapped by lack of equipment, with the result that workers with designing talent and technical experience are not fully employed. Amalgamation of the smaller plants is recommended.

Officials are citing the German coordination of industry which results in optimum production. It is pointed out that there are but 200 machine tool builders in Germany while Japan has over a thousand. By a process of merging it is proposed to decrease this number to 400 plants qualifying for special privilege on account of superior technique and large capacity.

Another cue taken from Germany is embodied in the proposal to compel machine tool makers to plough back a portion of their profits into plant expansion and research. The present system is like that in the United States: companies are unwilling to reinvest their earnings because of a high tax on profits.

Employment Increases

Since the outbreak of the Sino-Japanese war three years ago, employment in the machinery and tool industries has increased 121 per cent. A survey by the government Bureau of Statistics disclosed that 32,000 workers have found employment in the machinery industry during the last six months. This brings the total to 462,000. In addition, 487,000 workers are employed in the shipbuilding, rolling-stock, automotive and aircraft industries. This is an increase of 24,000 over six months ago.

Latest balance sheets of the leading Japanese machine tool makers disclose a uniformly fine profit, with no firm paying dividends of less than 10 per cent. All firms realized profits of 30 per cent or better against paid-up capital which has left ample reserves to be ploughed back into expansion projects or to be written off against depreciation. Most firms earned higher profits than a year ago.

Meanwhile imports of machine tools, parts and accessories have decreased for the first five months of 1940. During this period imports were valued at $15,116,400, as compared with $19,635,200 for the corresponding period of 1939

McKenna Metals Co. Decrease Prices; Small Buyers Gain

LATROBE, PA.—The McKenna Metals Co. has announced a new low price schedule on standard Kennametal tools and blanks. The feature of the new schedule on standard tools and blanks for turning, facing and boring of steel castings, forgings and bar stock is that small shops get the same price as previously available only to a few large buyers. There are lower tool making charges on standard tools, and tools now are furnished ground ready for use. The new price list is known as No. 4.

Carboloy Co. Reduces Prices, Also Standardizes Carbide Tools

DETROIT—A sharp reduction has been made in the price of carboloy cutting tools by the Carboloy Co., Inc. The new price schedule has been made possible by economies resulting from mass production, together with standardization of a simplified line of tools comprising but five styles in three grades. The new standardized line is designed to cover 80–90 per cent of all applications of cemented carbide tools. The new tools will be carried in stock, ready for shipment, completely ground and ready for use, including even the grinding-in of chip breakers on tools designed for machining of steel.

Typical new standard tool at $1.85 compares with tools previously costing $5.84 in lots of one. In quantities of 50 or more the tools now cost 90 cents. This is the sixth price reduction on cemented carbide metals since 1929. Of the three standardized grades of tools, one completely new grade is for steel cutting and two for cast iron. Mass production was given impetus when the company put into operation its new million dollar plant in 1939. The price reductions apply to special tools, tool bits, dies, wear resisting inserts, etc., the extent of the reduction depending on the amount of carbides used in each type.

NYA Will Soon Launch Training Program for Machine Shop Practice

CINCINNATI—The National Youth Administration in this area will soon inaugurate a training program for machine shop practice. Funds have already been appropriated and equipment, including lathes, milling machines, drills, screw machines, etc., has been purchased. Classes will meet in a staggered system to accommodate approximately 600 trainees. Instruction will be held under the direction of several Cincinnati shop executives who have been retained by the NYA for this purpose.

WATCHING WASHINGTON

Transfer of World War tanks to Canada regarded as initial step toward much broader moves to aid the British. House will vote on "bankable contract." No merchantship curtailment

By BLAINE STUBBLEFIELD

WASHINGTON — About 300 World War tanks being sold to Canada "for training purposes" occupy an international trade status similar to that of the old destroyers that were sold to England. The value of the tanks and the ships is not nearly as important as the political significance of their transfer. These sales are regarded as initial steps toward much broader moves to aid the British.

Mr. Roosevelt's bold sale of the destroyers, on his own initiative, met with such general approval that in the opinion of some observers, he will be encouraged to go farther yet. Specifically, if the British hold out, they eventually will collide with our Johnson law, forbidding credit to nations in default to us. Pressure will be brought to make a way around the law.

Then, as more of Britain's defense plants are bombed out of action, U. S. sales of munitions and supplies to England will increase, and there will be a demand for more of our war ships to convoy the shipments. The next move would be a call for repeal of our neutrality law, so that our ships could deliver supplies to Britain.

Incidentally, some Army officers admitted that while the old tanks being sold to Canada are too slow and obsolete to meet other tanks in battle, they might be worth their freight to England to serve as "mobile pill boxes." Again incidentally, announcement of the sale to Canada was made by a Congressman, while the War Department had nothing to say officially, which indicates a deplorable lack of team work in the defense program.

Discuss Tin Industry

Congressmen frequently talk "out of turn" these days. They don't like so much autonomous business being done by the Administration, the Defense Commission, etc. This time it's Sen. Warren Barbour (Rep.) of New Jersey. He says a final decision is expected soon on details of a federally-financed tin industry for defense. The Government would aid the setting up of smelters to process Bolivian ore. The matter is being discussed privately by the Defense Commission, RFC, and members of the smelting industry. But officials in other government agencies in charge of metallurgy, meanwhile, say there is no shortage of tin and none in prospect. The price situation is satisfactory too, they say. One of them indicated that Sen. Barbour was trying to get some tin smelters located in New Jersey. Anybody interested in tin will do well to keep a close eye on Washington for a while.

Bankable Contract Plan

Legislation that would permit contractors to assign their claims against the Government to lending agencies as security for loans for plant expansion and equipment, has been approved by the House Judiciary Committee and now goes to a vote before the House. It still has to be passed on by the Senate. This legislation is wanted by the Administration to implement a "bankable contract" plan proposed by the Defense Commission, RFC, and Army and Navy jointly. Under the plan, if and when Congress approves, any contract with the Government for $3,000 or more may be assigned to a federal or private lending agency as security on a loan, to be amortized in five equal annual payments. This procedure, it is expected, will greatly facilitate the defense program by enabling manufacturers to equip themselves to bid on government requirements or to sub-contract to other contractors.

NEW GOVERNMENT PLANT

WASHINGTON — Savage Arms Corp. has agreed to operate a machine gun plant for the government. The plan is to install $17,600,000 worth of government-owned tools in the present Savage plant, after which quantity contracts for production will be awarded to the company. Meanwhile slow progress is being made in getting the 70 or so government-owned private-operated munitions plants underway (the Savage plant is only the fourth), and the list is still being continually modified. The latest change reflects realization that aerial bombardment is becoming a substitute for artillery barrages. Although the number of TNT and smokeless powder plants have been about equal, the present schedule of TNT plants has now been upped from four costing $42,000,000 to perhaps six bigger plants costing something like $100,000,000.

No Curtailment of Merchant Ships

Asked by AMERICAN MACHINIST whether their merchant ship building program might be curtailed for lack of yard space, due to the Navy's huge construction orders, officials of the Maritime Commission said they expected little trouble. They explained that most of their merchantmen building are in yards not engaged in naval construction. In some cases, where commercial and naval buildings are both under way in the same yard, the merchant ships will be finished and no more will be laid down there. The additional load pushed on the commercial yards by Navy expansion will be taken on by construction of additional ways. There are a few World War yards that could be rehabilitated, but in most cases new yards would be cheaper. A few new yards may have to be built. The Commission has been making ready for a shift ever since the big navy program showed on the horizon. Twelve C-3 cargo ships have just been ordered at a cost of $37,000,000 bringing the total of vessels under construction or order by the Commission to 174.

Enigma—Madden's NLRB Job

Presumably the President is approaching prospects who, presumably, are turning down the offer of the Madden hot seat on the Labor Relations Board. Dr. William Leiserson told AMERICAN MACHINIST that he and Edwin S. Smith are functioning as a Board majority, since Madden's term expired August 26. Asked what happens when he and Smith disagree, Dr. Leiserson said, "Nothing happens," and left us to form our own opinion. Asked what he would do if Madden were reappointed, Dr. Leiserson said he couldn't answer. The talk of this town is that FDR is under CIO pressure to reappoint Madden, and that he would do it if the pyrotechnic Mr. Smith would resign, making a spot for a third member who would be sympathetic with the moderate Leiserson. But Smith won't walk the plank. Even if the Board is made moderate by appointments, the NLRB will not function that way until and unless a lot of its subordinate radicals are removed. Nathan Witt, secretary, is one that is tagged to get the axe.

PLANT DRAFT NOT LIKELY

WASHINGTON — The Senate-House conference committee has agreed on the army conscript bill. It is thought by observers here that the amendment allowing seizure of plants by the President was a political gesture which will enable Congressmen to answer constituent complaints against drafting with: "Yes, but we drafted business too" To bear this out the plant draft amendment has since been modified. The President can act now only when danger is imminent and when other sources of supply fail. Plants cannot be seized outright but may be taken and operated on a rental basis.

Military Service For All Will Reduce Machine Tool Production, Say Canadian Industrialists

MONTREAL—Canadian industrialists are greatly opposed to the government's decision to exempt no one between 18 and 35 from compulsory military training. Although 30,000 men in the 21-age group have been called up for the 30-day training period, employers, backed by the government's labor department, vehemently contend that, unless certain exemptions are made, war materials may not be delivered on schedule and the entire wartime industrial program may be thrown out of gear.

Most of the established industries working on war orders, however, are well situated as regards substitutes and reserves of trained men The companies which are particularly objecting are the newer war industries such as aircraft. Machine tool makers are also objecting strenuously as a shortage of skilled workmen already exists in this industry. The final decision awaits the action of the Prime Minister and his cabinet. They may rescind the order.

Up to the end of August the government had made commitments totaling $165,000,000 for construction of new plants which are scheduled to have an annual productive value of $800,000,000. Canadian government purchases have exceeded $300,000,000, and Canadian purchases for Britain have amounted to $85,000,000, a total of $550,000,000 for the eleven months that Canada had been at war.

More Plants Authorized

This month the government has already authorized the construction of three more plants at a capital commitment of another $17,500,000 The plants, which will be in production next year, include an $8,000,000 chemical plant in Alberta, a $7-000,000 gun plant and a $2,500,000 rifle plant The chemical plant will be operated by the government owned Allied War Supplies Corp and the rifle plant will be administered by the newly created government owned Small Arms, Ltd. The gun plant is scheduled to have an annual output of $40,000,000 to $60,000,000 Allied War Supplies Corp. will also administer the previously committed $50,000,000 chemical and explosives plant. Sorel Industries Ltd., established in 1939 to make 25-pounder guns for Britain, has been taken over by the government, which will spend $5,000,000 to equip the plant for the production of naval guns

Britain continues to give new orders for Canadian Hurricanes. Since the original experimental order for 60 Hurricanes several months ago, Britain has increased the number ordered to 600 at an approximate total cost of $18,000,000.

The following contracts have been awarded recently: Aircraft supplies, Canadian Pratt & Whitney Aircraft Co Ltd., Longueuil, Que., $169,973; Packard Motor Co., Detroit, Mich., $2,582,087; British Aeroplane Engines Ltd., Windsor, Ont., $34,204. Mechanical transport, Ford Motor Co. of Canada, Ltd., Windsor, Ont., $111,-503; Kelsey Wheel Co. Ltd., Windsor, Ont., $25,210. Machinery and tools, T. E. Ryder Machinery Co., Montreal, $13,880; Bausch and Lomb Optical Co., Rochester, N. Y., $157,429. Munitions, Defense Industries, Montreal, $170,386; Dominion Arsenal, Quebec, $569,807.

U. S. Government Contracts Awarded to Metal-Working Firms

(Other Metal Working Contracts on Page 728)

Contractor	Gov't Agency	Commodity	Amount
Budd Wheel Co., Detroit, Mich	War	Projectiles	$1 198,339
American Forge Div. of The American Brake Shoe & Foundry Co. Chicago, Ill	War	Sheet forgings	624,000
Colt's Patent Fire Arms Mfg Co., Hartford, Conn	War	Pistols	50,737
Jackes-Evans Mfg Co. St Louis, Mo	War	Arrestors	32,038
Midvale Co. Philadelphia Pa	Navy	Liner forgings	74,740
Crucible Steel Co. of America, New York, N. Y	Navy	Gun forgings	208,536
Erie Forge Co., Erie Pa.	Navy	Liner forgings	60 721
Pennsylvania Forge Corp., Philadelphia, Pa	Navy	Liner forgings	40,118
Bethlehem Steel Co. Bethlehem, Pa	Navy	Liner forgings	97,162
Crucible Steel Co. of America, New York, N. Y	Navy	Gun forgings	458 458
Chrysler Airtemp Sales Corp. Dayton Ohio	War	Field cabinets	235,000
Parish Pressed Steel Co. Reading, Pa	War	Field cabinets	278 750
Chase Brass & Copper Co., Inc., Waterbury, Conn	War	Cartridge cases	1 353 505
American Brass Co. Waterbury, Conn	War	Cartridge cups	155,353
Yellow Truck & Coach Mfg Co., Pontiac, Mich	War	Trucks	15 428,038
Fargo Motor Corp., Detroit Mich	War	Trucks	11,050,985
White Motor Co., Cleveland Ohio	War	Scout cars	5 412,956
American Car & Foundry Co., New York, N. Y	War	Light tanks	11,406,051
Mack-International Motor Truck Corp., Washington D C	War	Trucks	66,848
Pennsylvania Forge Corp. Philadelphia Pa	Navy	Gun forgings	104,217
Crucible Steel Co. of America New York, N. Y	Navy	Gun forgings	882,300
Midvale Co., Philadelphia, Pa.	Navy	Gun forgings	2,282,820
Meigenthaler Linotype Co. Brooklyn N Y	War	Telescope mounts	545,591
National Tube Co. Pittsburgh Pa	War	Forgings	52,276
Charles J. Dickgrasser & Co., Derby, Conn	War	Platform assemblies	36,852
Wm Scrimgeour Washington D C	War	Parts for field	60,675
Bethlehem Steel Co., Bethlehem, Pa	War	Shell	26,344
York Safe & Lock Co. York, Pa	War	Gun carriages	794,300
Struthers Wells-Titusville Corp., Titusville Pa	War	Propeller shafts	82,362
Henney Motor Co. Freeport, Ill	War	Field ambulances	37,453
Ryan Aeronautical Co. San Diego, Cal	War	Training airplanes	2,074,234
Beech Aircraft Corp., Wichita, Kansas	War	Training airplanes	4,847,217
Vultee Aircraft, Inc., Vultee Field, Downey, Calif	War	Training airplanes	7 488,782
Scovill Mfg Co. Waterbury Conn.	Ordnance	Ammunition parts	288,200
J. G. Brill Co., Philadelphia Pa	Ordnance	Artillery	148,060
Struthers Wells-Titusville Co. Titusville Pa.	Ordnance	Forgings	36,078
National Forge & Ordnance Co., Irvine, Warren County Pa	Ordnance	Forgings	39,685
Crucible Steel Co. of America, New York, N. Y	Ordnance	Forgings	40,587
Barnard Aviation Equipment Co., Inc., Ashley, Pa	Ordnance	Fire control equipment	90,898
Bell & Howell Co. Chicago, Ill	Ordnance	Fire control equipment	322,512
Saginaw Stamp & Tool Co., Saginaw, Mich	Ordnance	Trailers	234,562
American Car and Foundry Co., New York, N. Y	War	Ammunition	39,200
Peco Mfg Corp., Philadelphia	War	Forgings machining	295,000
Lansdowne Steel & Iron Co., Morton, Pa	War	Shell forgings	133,518
Aluminum Co. of America, Cleveland, Ohio	Navy	Forgings	20,690
Bethlehem Steel Co., Bethlehem, Pa.	Navy	Forgings	35 354
General Drop Forge Co., Inc., Buffalo, N. Y.	Navy	Forgings	20,017
Morton Mfg Co., Muskegon Heights, Mich	Navy	Propeller and profiling machines	113,000
General Electric Co., Schenectady, N. Y	War	Electrical equipment	61,560
Beech Aircraft Corp., Wichita, Kans	War	Airplanes	3,510 746
Livingston Shipbuilding Co., Orange, Tex...	Navy	Surf landing boats	118,824

INSIDE DETROIT

Ford will build Pratt & Whitney engines at the rate of almost one per hour; to save time Ford also will build many of the machine tools required. Chevrolet plans for 1,100,000 cars

BY RUPERT LE GRAND, DETROIT EDITOR

DETROIT—In connection with its program to produce Pratt & Whitney engines for the government, Ford has already broken ground for a two-story 600,000 sq. ft. plant adjacent to the huge tool and die plant in the Rouge Construction will be completed within 100 days, and the plant may produce motors within eight months. To save tooling-up time, the Ford toolroom will build many of the machine-tools required Since many of the engine parts will be small, the Ford-built equipment will be of miniature size such as now in use at the Willow Run lock plant and the plastics department in the Rubber plant

Ford officials believe that they can produce fifteen Pratt & Whitney engines in two shifts, or practically one per hour.

The Ford twelve-cylinder liquid-cooled aviation motor may soon reach the tooling-up stage. A high official stated that: (1) tooling up for a projected new plant in the Rouge may soon commence, (2) motors will probably be in production within a year to eighteen months, (3) the plant will be equipped to produce Ford aircraft motors in larger volume than the Pratt & Whitney undertaking, (4) Ford will go ahead with these plans although the motor has not been approved by the Army, and Air Corps tests can not normally be completed in less than a year, (5) the liquid-cooled motor is strictly a Ford design which will be manufactured along proved Ford engine building practices, (6) no attempt has been made to copy the Rolls-Royce or Hispano-Suiza designs, and (7) the Highland Park plant is unsuitable for aviation-engine production because of the problems involved in trucking materials and parts fabricated in Rouge primary producing divisions.

Chevrolet Is Conservative

Press previews of 1941 models are over, and most makes will be seen by the public before the end of September. Chevrolet showed 1941 lines with marked style advances and longer wheelbase to newspapermen on Sept. 10, and has scheduled the public announcement for Sept. 21. A goal of 1,100,000 units for 1941 has been announced by Chevrolet, which certainly is a conservative statement in view of the fact that many were produced in 1940, and Alfred Sloan predicts a 10-20 per cent gain for the industry.

Ford's preview was more elaborate than in recent years. On Sept. 11, 200 preview guests were taken from Detroit to the River Rouge dock on chartered boats, then transferred to seat-equipped railway flat cars and hauled through the Rouge plant in comfort. Besides a novel view of manufacturing operations, newspapermen were made acquainted with the possibilities of the Ford plant in national defense. Chrysler, which has concentrated its major styling and mechanical changes in Dodge, DeSoto and Chrysler cars, previewed those lines on Sept. 12. The Chryslers will be announced this weekend. Packard wound up the season by showing its new models at its proving grounds at Utica, Mich.

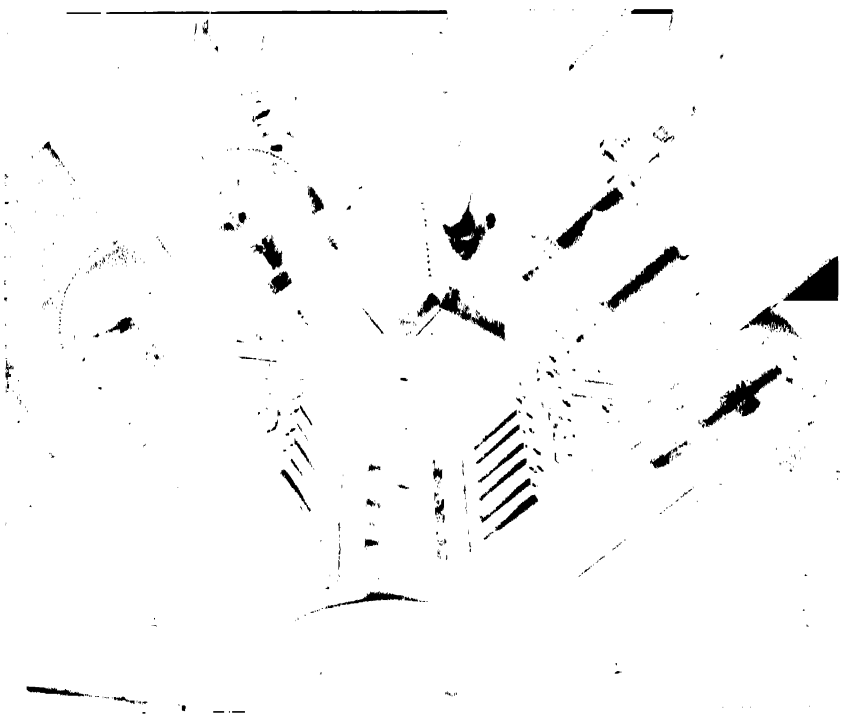
Ford Six Dropped

Ford products, as reported previously, represent continued evolution of the body design principles utilized by that manufacturer in the past few years, but the 1941 models can be called new, not merely revised. The Ford will be offered in two series, deluxe and super deluxe. Both will be powered with the 85 hp V-8 engine The six-cylinder engine is definitely "out" And the Ford will not be offered with an option of the 95 hp. V-8 engine

Ford bodies have been widened as much as 7 in. While a narrow runningboard is still visible, the actual body width closely approximates that associated with the Torpedo design, although Ford will definitely not follow the Torpedo trend. Glass area has been increased about four square feet. An exceptionally large curved rear window follows the body contour. Longer wheelbase and improvements in springing and shock absorbers promote an improved ride

NEW PARTS FOR FENDERS

DETROIT—Front fenders with replaceable elements will be featured on at least two lines for 1941. As seen on Oldsmobile the lower half of the fender, from the center of the lamphouse to the rear skirt, consists of two stampings bolted to the upper half, and with the horizontal joint concealed by a chromium-plated molding. Ford is expected to use the same principle. Fenders have become such deep-drawn, massive affairs that manufacturers evidently are trying to save die cost, besides giving the motorists a break when jitterbug drivers crumple expensive sheet metal



Mechanical Giant—*Is the automatic boring apparatus used in machining the Lincoln-Zephyr engine block. In one swift operation this machine establishes simultaneously the 75-degree angle for all 12cylinders of the V-type engine. It is accurate to within 1/1,000 of an inch*

The Mercury will also be wider and longer, have improved springing and shock absorber control, but will again be powered with the 95 hp V-8 engine Faster acceleration is obtained through an improved transmission Six body types, including a new coupe and a station wagon, will be offered in the Mercury line

The Lincoln Zephyr will be built in four body types—sedan coupe, 6-passenger club coupe, and a convertible coupe Four color options will be offered in upholstery and trim Door latches are push-button operated The Lincoln Continental model, first introduced last year, will include the former cabriolet and a new coupe To top the line Lincoln will have 138 in wheelbase custom 8-passenger sedans and limousines with exceptional roominess This car is built in the unit body and frame construction evolved for the Zephyr Luxury refinements such as hydraulic window lifts will be featured

Approximately 60 refinements and improvements will be found in the Ford, Mercury Lincoln-Zephyr and Lincoln Continental and custom lines A new high note is struck in luxurious appointments and interior color harmony Plastics play a large part in decorative effects achieved in the interior, while a greater amount of rustless steel and chromium plated moldings embellish the exterior

New Airflow Chrysler

From 1934 to 1937 Chrysler built the Airflow and it has since greatly influenced automobile body design Always proud of the original Airflow Chrysler is now ready to announce a new Airflow line, which is a notable advance over its namesake The 1941 cars are wider as much as 7½ in longer and 1½ in lower than last year Much of the additional roominess has been achieved below the window line The body bells at this point, giving rise to the term 'spacefiared" Thus the edge of the front seat is approximately five feet wide or greater than the original Airflow

Chrysler offers four lines for 1941 in 26 models – the Royal and Windsor sixes the New Yorker and Crown in 26 models- the Royal and Windsor models measure 210 in over-all, are powered with a larger 112 hp "Spitfire" engine

Mechanical improvements include a multiple-jet carburetor to increase horsepower and economy and a new type of thin-babbitt main and crank shaft bearings claimed to increase bearing life up to 500 per cent The frame, said to be the strongest and most rigid ever used in a Chrysler car, is a double channel type, two U-shaped girders being welded together to form the side rail This construction permits omission of the X-member The front cross member is a box section, welded and riveted to side rails

Crowell Reelected President of Army Ordnance Association

WASHINGTON—Brig Gen Benedict Crowell special consultant to Secretary of War Henry L Stimson, has been reelected president of the Army Ordnance Association Gen Crowell was a founder of the association twenty-one years ago and has served as its president continuously since He was Director of Munitions in the World War Cabinet of President Wilson and was the Assistant Secretary of War under Newton D Baker General Crowell is president of the Central National Bank of Cleveland

Elected vice-presidents of the association were Col William W Coleman chairman Bucyrus-Erie Company Milwaukee, formerly special assistant to the Chief of Ordnance, U S Army, and Col Frederick H Payne of Greenfield, Mass, Assistant Secretary of War under President Hoover and now chief of the Hartford (Conn) Ordnance District

Elected directors of the association were Col Frank A Scott of Cleveland first chairman of the General Munitions Board and organizer of the War Industries Board in the World War, Colonel Robert P Lamont, New York Secretary of Commerce under President Hoover, and Col James L Walsh, New York consulting engineer first secretary of the Association and founder of its journal



BENEDICT CROWELL

U. S. Government Contracts Awarded to Tool Makers

(Defense Contracts on Page 728h)

Contractor	Govt Agency	Commodity	Amount
Dana Tool D Nast Machinery Co Philadelphia Pa	Navy	Taps dies	$21 722
Lodge & Shipley Machine Tool Co Cincinnati Ohio	Navy	Engine lathes	19 043
Harris Seybold Potter Co Cleveland Ohio	War	Turning machine	15 000
Wisconsin Axle Div Timken Detroit Axle Co Oshkosh Wis	War	Transmission parts	26 448
The Bullard Co Bridgeport Conn	War	Boring mills	136 614
L L Lssley Machinery Co Chicago Ill	War	Metal working	17 822
Marshall & Huschart Machinery Co Chicago Ill	War	Boring machines	201 329
Cincinnati Milling Machine & Cincinnati Grinders Inc Cincinnati Ohio	War	Grinding machines	17 003
Brown & Sharpe Mfg Co Providence R I	War	Grinding machines	25 2 1
Kearney & Trecker Corp Milwaukee Wis	War	Milling machines	15 680
Pratt & Whitney Div Niles Bement Pond Co West Hartford Conn	Navy	Drilling machines	38 008
Robbins & Myers Inc Springfield Ohio	Navy	Hoists	12 627
The Ajax Mfg Co Cleveland Ohio	Navy	Bolt & rivet machines	21 768
Sebastian Lathe Co Cincinnati Ohio	WPA	Lathes	23 200
Lloyd & Arms Inc Philadelphia Pa	War	Drilling machine	10 340
Henry Prentiss & Co Inc Boston Mass	War	Radial drills	76 144
Stedfast & Rudston Inc Boston Mass	War	Engine lathes	19 288
Gisholt Machine Co Madison Wis	War	Turret lathes	29 316
Harnischfeger Corp Milwaukee Wis	War	Bridge crane	22 625
Waterbury Farrel Foundry & Machine Co Waterbury Conn	War	Cartridge gaging machines	10 000
Austin Hastings Co Inc Cambridge Mass	War	Hydraulic planer	35 715
Kearney & Trecker Corp Milwaukee Wis	Navy	Milling machines	57 968
Reed Prentice Corp Worcester Mass	Navy	Lathes	111 670
Thompson Grinder Co Springfield Ohio	Ordn	Grinding machines	46 200
Pheoll Mfg Co Chicago Ill	Navy	Screws and nuts	64 985
Warner & Swasey Co Cleveland Ohio	Navy	Turret lathes	10 274
Wm Sellers & Co Inc Philadelphia Pa	Navy	Boring machines	36 428
The Bullard Co Bridgeport Conn	Navy	Turret lathes	17 52
Wm Sellers & Co Inc Philadelphia Pa	Navy	Planers	156 220
Niles Bement Pond Co Div Pratt & Whitney East Hartford Conn	War	Milling machines	31 488
Chambersburg Engineering Co Chambersburg Pa	War	Power hammers	14 600
Henry Prentiss & Co Inc New York N Y	War	Grinding machines	13 986
Edward A Lynch Machinery Co Philadelphia Pa	Navy	Drilling machines	17 065
Niles Bement-Pond Co Pratt & Whitney Div Hartford Conn	War	Die sinking machines	38 564
Thompson Grinder Co, Springfield Ohio	War	Grinding machines	46 200
Kearney & Trecker Corp Milwaukee Wis	Navy	Milling machines	29 002
Lapointe Machine Tool Co Hudson Mass	War	Broaching equipment	73 657
Davenport Machine Tool Co Inc Rochester N Y	War	Screw machines	34 863
William Sellers & Co Inc Philadelphia Pa	Navy	Drilling machine	35 805
Marshall & Huschart Machinery Co of Indiana Indianapolis Ind	WPA	Milling machines	30,782

NAMES in the NEWS

K T. Keller, president of the Chrysler Corp, became chief executive of the corporation as the Board of Directors voted to discontinue the office of chairman of the board Mr Keller had been president for two years since Walter Chrysler became ill in 1938 Herman L Weckler, vice-president and general manager, was elected to the board to fill the vacancy

William S Knudsen, president General Motors Corp, has tendered his resignation as president in order to devote himself completely to his governmental duties as a member of the National Defense Advisory Commission Mr Knudsen had been on leave of absence from General Motors since June 1, 1940

C L McCuen, vice-president, was elected a member of the Administration Committee, and Harley J Earl, director of the corporation's styling section, was elected a vice-president

J F Brown, formerly chief engineer of South Works, has been appointed construction engineer for the Chicago District of the Carnegie Illinois Steel Corp A J Hulse has been named to succeed Mr Brown as chief engineer Mr Brown was first employed at South Works in 1904 in the civil engineering department Mr Hulse entered the service of the corporation in 1936 as assistant chief engineer at South Works

Celebrates 65th Anniversary



HARRY WILSON, SR.

Harry Wilson, Sr., who is a timekeeper at Jessop Steel Co., Washington, Pa., is now celebrating his 65th year of combined service with the company, and its one-time parent concern, Jessop of Sheffield. Mr. Wilson is the fourth direct descendant of Wilsons who have worked continuously for Jessop from 1774 to the present time, and is the father and grandfather of four Wilsons now employed by the American Jessop

New Board Member



HERMAN L. WECKLER

Chief Executive



K. T. KELLER

Charles L Clarke was made superintendent of yards and transportation He has been employed at South works since 1896 when he began as a switchman Howard C Brown has been named assistant superintendent of yards and transportation to succeed Mr Clarke

Roy Hunter and P Robert Foseid have been named to the sales force of Gisholt Machine Co, Madison Wis Both men will handle the complete line of Gisholt turret lathes, automatic lathes and balancing machines Mr Hunter will be in charge of the Cleveland office while Mr Forseid will make his headquarters at Philadelphia

George A Mohr has been elected secretary of the Boye & Emmes Machine Tool Co of Cincinnati, Ohio

George M Class formerly chief engineer of the Gisholt Machine Co, of Madison, Wis, has recently been elevated to the post of vice-president in charge of engineering Mr Class has been a member of the Gisholt organization for 16 years

Milton P Higgins, resident manager of the Electric Furnace plant of the Norton Co at Chippawa, Ont, for the past two years, has been transferred to the Worcester headquarters as assistant manager.

S P Broome, special representative of the Crucible Steel Co of America, has been appointed to cooperate with the National Defense Advisory Commission. Mr Broome will conduct liaison work between the company and the Commission

Warner G Tilsher has been appointed Factory Manager of the Taylor-Winfield Corp Mr. Tilsher has been active in the development and manufacture of aircraft, streamline trains and other light weight structures In 1931 he designed the first airplane completely fabricated by spot welding

C W Sweeney has been named in charge of the Bunting Brass & Bronze Company's operations on the Pacific Coast

Carl H Youngdahl has been appointed assistant superintendent of the power production division of Carnegie-Illinois Steel Corporation He has served as division engineer in charge of operation maintenance and construction since 1928 Russell W Davy who succeeds Mr Youngdahl, received the post of construction engineer after serving in various capacities in the Civil Engineering Department

BUSINESS ITEMS

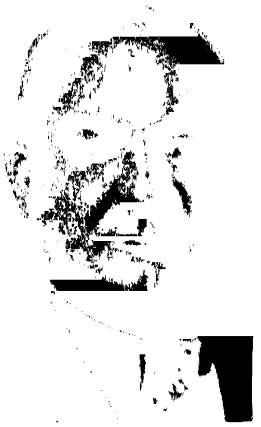
L & J Press Corp is taking over the business of the Loshbough-Jordan Tool & Machine Co, Elkhart, Ind The business consists of the manufacture and sale of the L & J Punch Presses

Sterling Pump Corp, Hamilton, Ohio, has purchased the turbine pump business of Roots-Connersville Blower Corp of Connersville, Ind Sterling will manufacture and sell this line of pumps in the future under their name

Reliance Electric & Engineering Co Cleveland, Ohio, has opened a sales office in Houston, Texas Frank A Denison, Jr, has been appointed district manager.

Carnegie Illinois Steel Corp has reached a settlement with the Cold Metal Process Co concerning patent

Liaison Officer



S. P. BROOME

Factory Manager



WARNER G. TILSHER

litigation which involved the so-called Steckel patents for equipment and processes for rolling in the cold reduction of steel products. By the agreement Carnegie and other subsidiaries of the United States Steel Corp. are licensed to operate under the patents for royalties set out in the settlement.

W A. Schofield has been appointed Michigan representative of the Metal Carbides Corp., Youngstown, Ohio

Stanley W. Sparks and C Nelson Sparks have organized the Sparks-Simplex Machinery Corp, Norwalk, Conn.

Patents for the manufacture of steel by the Bessemer Flame Control process have been granted Jones & Laughlin Steel Corp., Pittsburgh, Pa Patent applications covering Bessemer Flame Control have also been filed in many foreign countries.

Liberty Planer & Mfg. Co., Hamilton, Ohio, has been formed to succeed the Liberty Machine Tool Co. The new company will manufacture the complete line of Liberty double housing, open side and convertible planers. Harry A. Dingeldein and H. R. Ryan have been named president and vice-president respectively of the new organization.

PLANT EXPANSION

Grumman Aircraft Engineering Corp., is planning a new factory building which will cost between $1,000,000 and $1,500,000.

Glenn L Martin Co., Baltimore, Md., has launched the first of a series of factory additions which is expected to bring its total floor space to around 3,000,000 sq ft A huge expansion of the Middle River group will immediately add nearly 400,000 sq ft to the present 1,263,000 financed with the company's own funds.

Chain Belt Co., Milwaukee, Wis., is planning to erect a two-story addition to its plant

Cincinnati Bickford Tool Co, has filed plans for a plant addition to cost $140,000

Jacobs Mfg. Co., Hartford, Conn., has begun construction of its new $350,000 plant in Elmwood, Conn.

OBITUARIES

Gus F. Liden, 62, president and general manager of the Liden Mfg. Co, Lansing, Mich., died recently following an illness of two months. Mr. Liden was connected with the Lindell Drop Forging Co. until 1928 when he organized the Liden Mfg Co.

Robert Thomas Walsh, superintendent of the Pequonnock Foundry, Bridgeport, Conn., died last month.

Dr. Lester P. Breckenridge, 83, Professor Emeritus of Mechanical Engineering at Yale University, died recently. Dr. Breckenridge was at one time vice-president of the American Society of Mechanical Engineers, a former vice-president of the Western Society of Engineers, Chairman of the Super-Power Survey in 1920, and a member of the World Power Conference.

George C. Newell, Brown & Sharpe employee for over 35 years, died recently after a brief illness. Mr. Newell who was in the Screw Machine Mfg. Dept. when he joined the organization in 1905, had assumed the duties of supervising purchasing of plant equipment in 1939, which position he held at the time of his death.

Walter C. Marmon, 68, a pioneer automobile manufacturer, died recently. Mr Marmon was formerly chairman of the board of the Marmon-Harrington Co., manufacturers of trucks and tractors since 1931.

John Penton, 78, chairman of the board of the Penton Publishing Co. died at his home in California last week. Mr Penton started publication of The Foundry in 1892. He organized the Iron and Steel Press Co. in 1901 It became the Penton Publishing Co. in 1904, and published Steel and other iron and steel trade publications

MEETINGS

American Gas Association Annual Convention Atlantic City, N. J. Week of Oct 7

National Metal Exposition, Cleveland, Ohio Cleveland Public Auditorium Oct 21-25.

American Society of Mechanical Engineers Fall Meeting Spokane, Wash Sept 3-6.

National Association of Foremen Annual Convention. Hotel Gibson, Cincinnati, Ohio. Sept 26-29.

National Safety Congress and Exposition. Stevens Hotel, Chicago, Ill. Oct 7-11.

Society of Automotive Engineers National Aircraft Production Meeting Hotel Biltmore, Los Angeles, Calif Oct. 31-Nov. 2.

American Society for Metals. Annual convention Hotel Statler, Cleveland, Ohio. Oct. 21-25.

American Welding Society. Annual convention. Hotel Cleveland, Cleveland, Ohio. Oct. 20-25.

The Wire Association. Annual convention. Carter Hotel, Cleveland, Ohio. Oct. 17-23.

American Society of Tool Engineers. Semi-annual convention. Cincinnati, Ohio. Oct. 17-19.

American Gear Manufacturers Association. The 23rd semi-annual convention, Skytop Lodge, Syktop, Pa. October 14, 15 and 16, 1940

Society of Automotive Engineers National tractor meeting, Schroeder Hotel, Milwaukee, Wis., Sept 24-25 Annual dinner, Hotel Commodore, New York, N Y., Oct. 14.

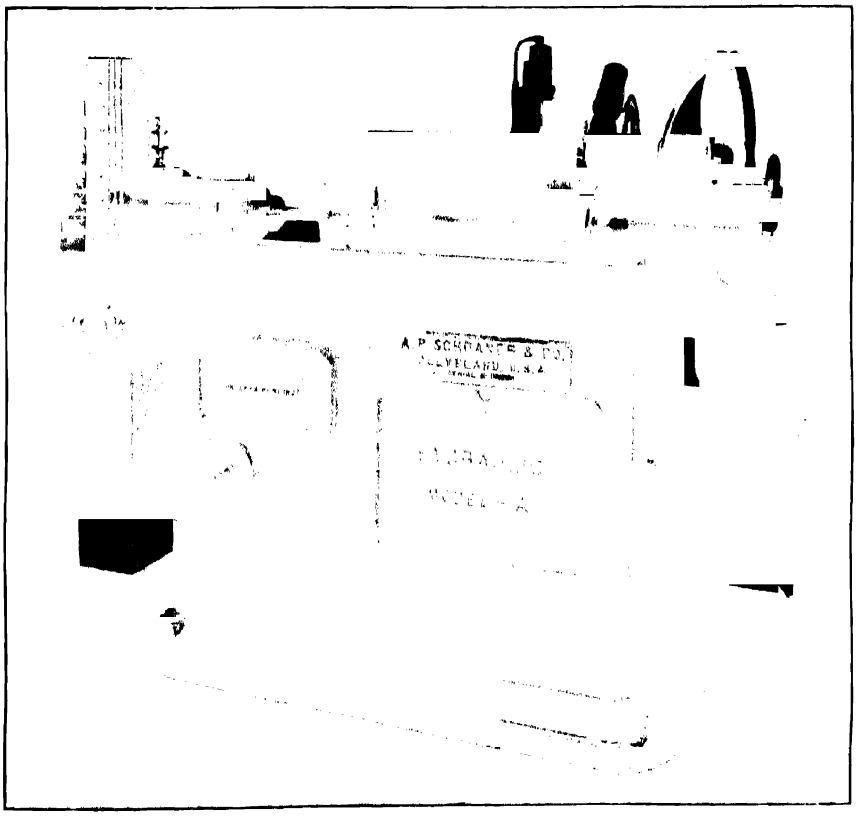
SHOP EQUIPMENT NEWS

Improved External Cylindrical Lapping Machine Permits Quick Change of Operating Set-Ups

An improved design of its Model A lapping machine, incorporating simple and convenient adjustments to permit quick changeover to various types of work, has been made available by A. P. Schraner & Co, Payne Ave. & E 33rd St, Cleveland, Ohio This machine is suitable for lapping external cylindrical surfaces on straight shafts, crankshafts, and plain bearings on many parts used in automotive, aircraft, machine tool and other industries

Machine consists of a welded steel base of box construction This base contains the hydraulic pump, piping, valves, clutch and electrical control panel Headstock and tailstock are mounted in the pan the tailstock being adjustable laterally to accommodate different lengths of work Headstock spindle is oscillated laterally with about ⅛-in movement by a back geared drive to the cam Tailstock has a spring center A cross rail, mounted at the rear of the base, carries the lapping heads These heads are adjustable laterally and are arranged to take interchangeable lapping shoes for various sizes of work Machine is fully hydraulic, with solenoid operated clutch and valves, and is equipped with pushbutton control Main drive motor, as well as the coolant sump, pump and filter arrangement, is mounted on the base at the rear

Paper or cloth abrasive of suitable grit is carried on spools at the front of each lapping head For each piece to be lapped the required amount of fresh abrasive is automatically fed into the lapping shoes and the used abrasive removed, thereby providing identical conditions for continuous production A production rate of from 150 to 250 pieces per hour can be obtained, depending on the type of job Finish obtainable is of the order of 2 to 3 micro-inches



Vertical Spindle Disk Grinder Made Available by Hanchett

Hanchett Mfg Co, Big Rapids, Mich, has developed a new vertical spindle disk grinder Identified as the No 153, this machine employs a grinding disk 1 in thick, which is made up in



eight sections These sections are attached to a steel plate by means of filister head screws passing through openings in the abrasive which is vulcanized to thin steel plates The steel disk plate is attached to a wheel flange 34 in in diameter and 4 in thick

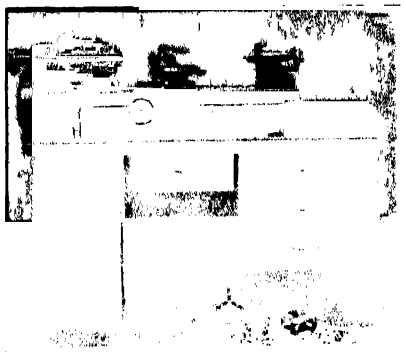
Wheel spindle is mounted in preloaded precision ball bearings and is driven through V-belts by a 25-hp vertical motor located within the machine base Spindle speed is 435 r p m Grinder can be arranged for wet grinding, if desired

A rugged oscillating type of wheel dresser is built into the machine Passing from the outside of the disk to the center, it makes it easy to maintain a true grinding surface at all times. Wheel dresser arm is entirely clear of the machine while work is being ground Openings beneath the grinding disks are provided for attachment to the dust exhaust system Approximate weight of the machine is 7,500 lb

Brown Precision Bench Lathe Has Quick-Change Belt Drive

The Model SP 9-in swing underneath drive bench lathe made by Brown Machine Co, 14-16 N. May St, Chicago, Ill, is suitable for screw cutting and other precision operations Mounted on a steel cabinet bench, this lathe as illustrated is provided with a headstock having a 1-in collet capacity spindle mounted on two large double Timken bearings. With this construction, it is possible to take heavy cuts without chattering

Steel cabinet bench is of all-welded construction and has three drawers



on one side and one in the middle Automatic belt shifter shifts belt on three-step pulley without the necessity of first slackening it Change gears are furnished to give a thread-cutting range of 4 to 40 threads per inch

With a countershaft speed of 255 r p m spindle speeds of 38, 61, 102 208, 334 and 565 r p m are possible Bed lengths of 36, 42 48 and 60 in provide center distances of 16 22 28 and 40 in Approximate shipping weights are 800 825, 850 and 900 lb

Special Broaching Machine Finishes Half-Round Holes In Various Sizes of Parts Without Tooling Changeover

American Broach & Machine Co, Div of Sundstrand Machine Tool Co Ann Arbor, Mich, has developed a special broaching machine to finish broach the half-round slots in differential cases of various sizes Machine employs the surface broaching principle, having four stations, with two fixtures at each station

A permanent tooling set-up is made possible with two fixture stations on each side of the machine Any one of four differential case halves making up two separate differential case assemblies can be finished without any tooling changeover

Machine itself, identified as the Model 4HC-18 horizontal broaching machine comprises a fabricated base containing the oil reservoir, coolant reservoir, coolant pump, hydraulic pumping unit, valving and motor An inclined trough conveys chips to one corner of the base where they are conveniently removed Four machine slide units are provided, one on each of the four sides All four cylinders are connected to the hydraulic pump unit, with the design such that any one side of the machine may be operated independently and two adjacent sides operated simultaneously by two different operators Separate machine control is provided for each cylinder slide assembly.

Specifications normal capacity, 4 tons, each cylinder, cylinder diameter, 5 in, broaching speed 18 ft per min, return speed, 28 ft per min, cylinder stroke, 18 in, over-all height 50 in, net weight with tooling 10 000 lb, and operating space required 14x14 ft

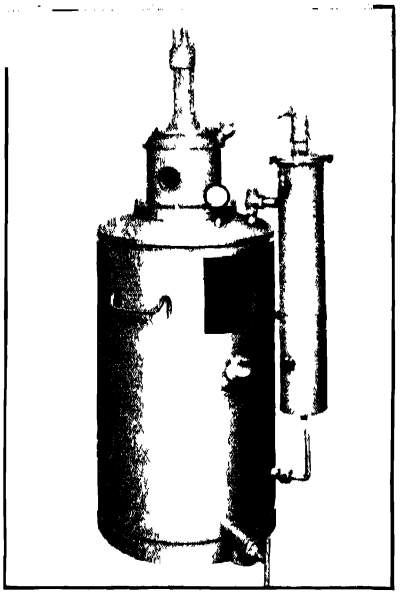
Portable Acetylene Generators Available in Four Capacities

Marquette Mfg Co, Minneapolis Minn has made available four portable acetylene generators ranging in capacity from 12 to 50 lb In addition to economy of operation these generators offer the advantages of small size and convenient handling

Operation is said to be very simple Filling is accomplished easily by loosening four wing nuts lifting the hopper from the generator and placing it bottom side up on the floor Carbide is added through the opening provided Twelve gallons of water are then placed in the main tank Hopper can then be replaced and tightened down and the generator is ready for service Charging is begun by lifting the handwheel at the top of the hopper Charging rate can be adjusted by turning the wheel Generator is entirely automatic thereafter An observation window permits the quantity of remaining carbide to be noted

Safety features include an interlocking bar to insure that no pressure exists in the generator before removing the carbide filler cap, a water seal tank to wash the acetylene and act as a hydraulic safety valve in the case of backfire and a flash-back valve and blow-off valve

The No 512 model holds 12 lb of carbide and 12 gal of water, stands 40 in high, weighs 95 lb and produces 24 cu ft per hr The No 515 holds 15 lb of carbide, 17 gal of water stands 50 in high weighs 96 lb and delivers 30 cu ft per hr The No 530 holds 30 lb of carbide and 33 gal of water, stands 61 in high, weighs 123 lb, and produces 60 cu ft

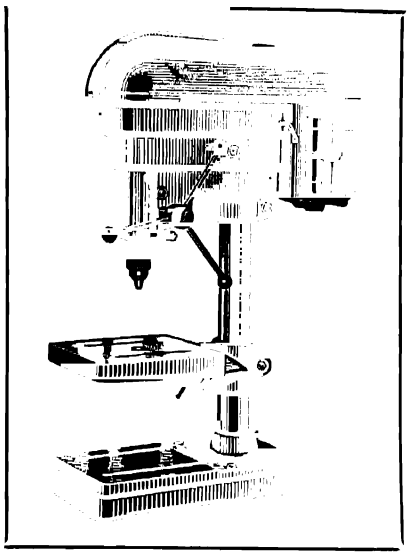


per hr The No 550 holds 50 lb of carbide, 55 gal of water, stands 69 in high, weighs 177 lb and delivers up to 100 cu ft of acetylene per hr

Boice-Crane Expands Line of "Helmet-Head" Drill Presses

Boice-Crane Co, 1730 Norwood Ave, Toledo, Ohio, has added several new models to its "Helmet-Head" line of drill presses with completely inclosed drives Additional models include single and multiple spindle floor





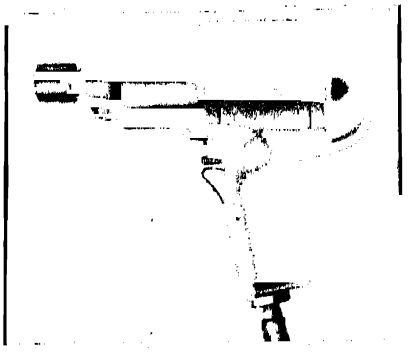
types, Morse taper spindle types, and an extensive range of slow-speed models having five speeds from 425 to 3,340 r.p.m. in both single and multiple bench and floor types.

Also added to the "Helmet-Head" line are several new high speed tapping machines. Separate drill press heads, columns and column flanges have also been made available for building up low-cost special drilling, reaming and tapping tools.

Chicago Pneumatic Wrenches Employ "Power-Vane" Motors

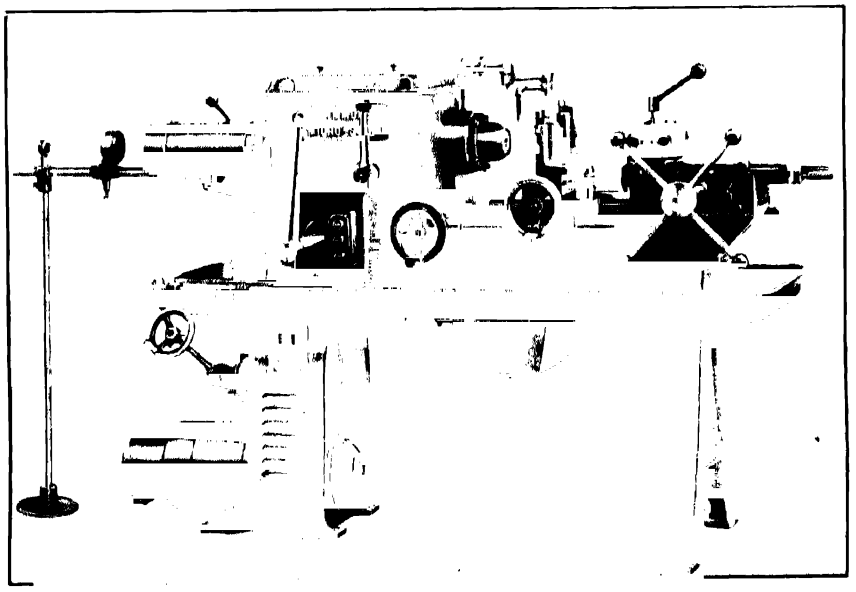
A line of reversible pneumatic wrenches developed by Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y., employs a slow speed "Power-Vane" rotary motor which is simple in design, efficient in operation and economical in maintenance. These wrenches have no gears or resilient members in the driving unit.

Light in weight and having a short



over-all length, these tools are said to be extremely easy to handle. Three models, the Nos. 344-R, 349-R and 360-R, handle bolts of ⅜, ⅝ and ¾ in respectively.

Maximum Production from Simmons Screw Machine Promoted by Built-In "Micro-Speed" Spindle Drive



An unusual advantage is claimed for the No. 2 turret screw machine offered by Simmons Machine Tool Corp., Albany, N. Y., in the "Micro-Speed" drive unit which provides 1,000 spindle speeds at the twist of a handwheel. Built into the machine base, this unit enables the operator immediately to select the best spindle speed for the stock being machined.

Designed for rapid production, this machine has a spindle mounted on Timken tapered roller bearings and has all bearings for sliding members accurately hand scraped. Head is cast solid with the bed to insure greatest rigidity. Turret is provided with six tool holes, arranged to hold tools with or without shanks.

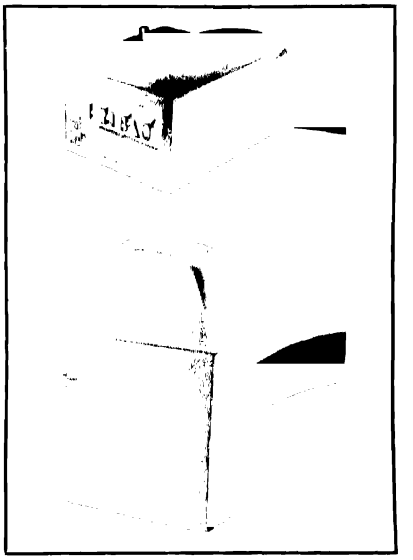
All levers are within convenient reach of the operator. On the headstock is a long lever for operating automatic chuck and bar feed, giving maximum leverage for closing collets. Cut-off is operated by a lever, although screw feed can be furnished.

Specifications: swing over bed, 14 in.; swing over cross slide, 6 in.; automatic chuck capacity—round, 1 in., square, ⅛ in., hexagon, ⅞ in. Hole in plunger is 1⅛ in. in diameter; that through the spindle is 1¼ in. Net weight of the machine is 1,600 lb.

Faster Stamping Possible With Double-Floating Safety Holder

A double-floating box-type safety holder offered by M. E. Cunningham Co., 115-117 E. Carson St., Pittsburgh, Pa., has been developed for faster and more efficient marking on hot, cold, flat, round, or angular surfaces. This holder is said to work equally well whether the surface is rough sheared, sawed or ground.

Holder is constructed with a sleeve



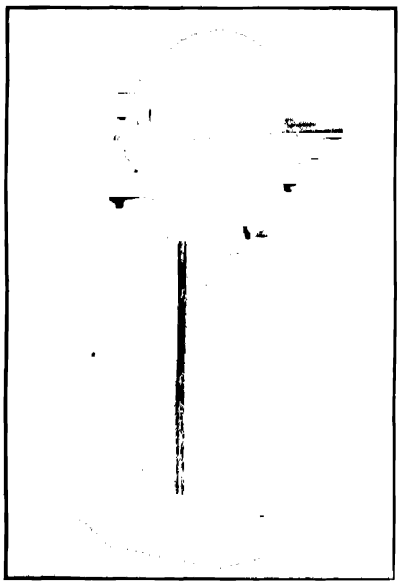
which levels or holds the floating type holder at right angles on the surface to be marked. Steel type also floats within the type holder. Because both holder and type are held loosely, a double leveling action takes place when the holder is struck with a hammer. Leveling sleeve prevents holder from tipping over when in use, and at the same time prevents pieces from flying in case one of the stamps should break or chip from misuse. Holder and type are made from patented safety steel which will not spall or mushroom.

Max 16-in. Disk Sander Suitable for Aircraft Work

The 16-in. universal floor model disk sander developed by Max Mfg. Co., 735 The Alameda, San Jose, Calif., has proved of particular value to the aircraft industry. Capable of surfacing wood, metal, plastics and

other materials quickly and accurately, this sander is simple in design and sturdy in construction

Working unit is mounted on top of a ground steel column which is pressed into a cast iron base Table assembly is attached to a worm gear mechanism which permits raising or lowering the table as required to any desired height Table size is 9½x18 in and is provided with trunnions and



locks at each end It can be set quickly by a large protractor and locked at any angle from 45 deg up to 45 deg down A positive 90 deg stop permits rapid repositioning of the work table

The sander is regularly equipped with a ½ hp ball bearing repulsion induction motor for either 110 or 220 volts The machine is also available as a bench model

Hand Forged Steel Punches Made Available by Bates

Hand forged steel punches, for both hand and machine use, have been made available by H O Bates 251–257 N Broad St, Elizabeth, N J

Left-hand photograph illustrates several sizes of round hand forged punches and a rawhide mallet used with them These punches can be furnished for cutting any practical shape or design Mallet is made of rawhide washers clamped tightly in a cast iron handle and is furnished in several weights to suit particular types of hand punching requirements

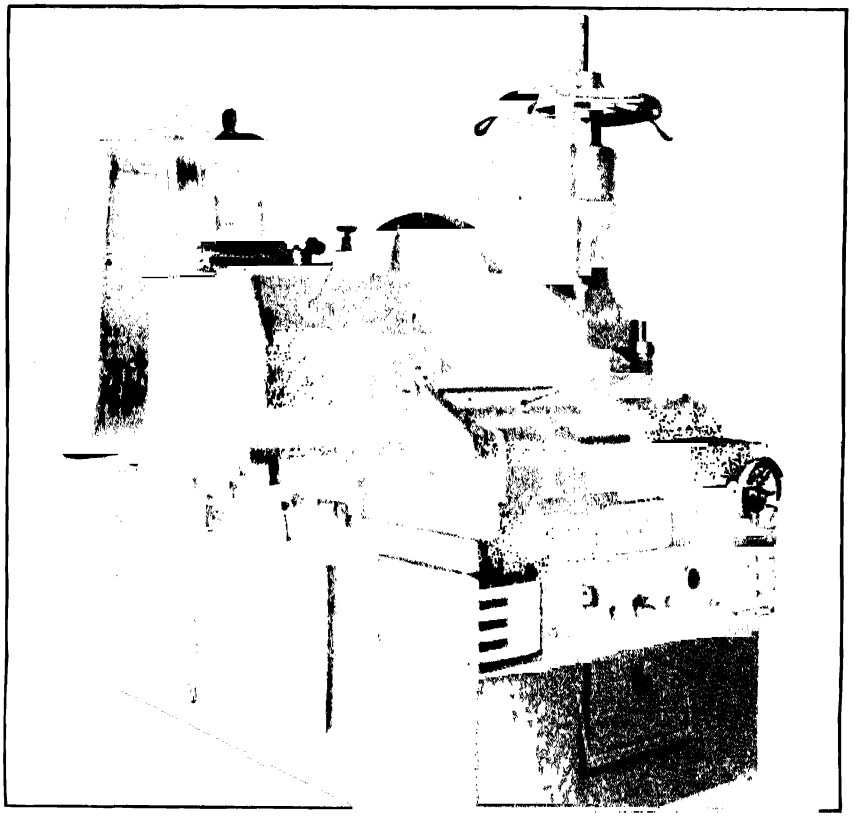
Center photograph shows hand forged press punches which have been developed to supplant steel rule dies These press dies are forged to any practical shape from wear resisting tool steel and after hardening are mounted on a steel backing plate for use in a foot or power press Dies can be detached for sharpening

Illustration at the right shows a high speed rotary punch for cutting round holes in resilient rubber or other pliable materials By tapering the cutting edge properly, accurate and clean holes can be cut with ease

Motch & Merryweather Hydraulic Cold Sawing Machine Intended for Heavy Duty Service

Motch & Merryweather Machinery Co, W Third & Lakeside Ave, Cleveland, Ohio, has developed a hydraulic cold sawing machine designed to withstand the severest service Identified as the No 3 cold saw this machine features a saw carriage of extremely rugged construction nine speed changes hydraulic feed and automatic lubrication

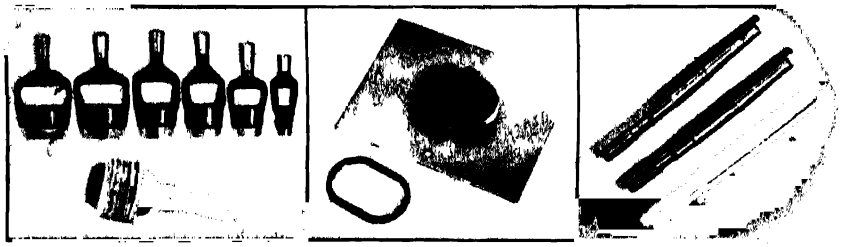
Saw carriage contains the entire drive to the saw blade A built-in



pump provides lubrication for all bearings and gears Main drive motor is mounted on this carriage and is connected to the drive pulley by multiple V-belts Saw rotation is controlled through a multiple disk clutch and brake running in oil operated from the front of the machine

Nine speed changes in geometrical progression are provided ranging from 18 to 134 ft per min Speed change gears are of the spur type sliding on hardened and ground multiple-spline shafts mounted on Timken bearings Gearing in the final drive train is helical with exceptionally wide face

Base is of box construction, and includes a cutting compound reservoir as well as an oil reservoir Hydraulic unit and control valves are in a separate compartment Hydraulic feed provides a stepless variable feed and quick return System is of the low pressure type Vane hydraulic pump is direct driven Motor pump and control valves form an integral unit inserted in the bed In this unit are two adjustable valves, one of which limits the total feed pressure to the saw carriage, while the second insures that the work is clamped prior to feeding the carriage Thus the saw



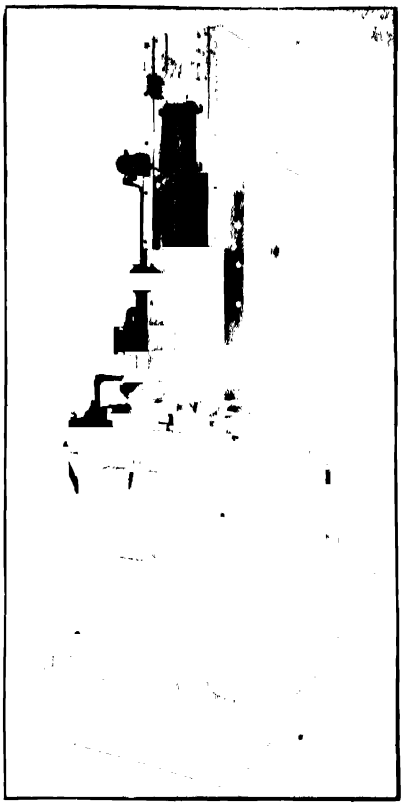
blade is protected independently of the rate of feed.

Controls are centralized on a panel at the front. Two handles control the motion of the saw carriage and that of the vertical vise jaw. Other features include: pressure gage to measure feed and clamping pressures, ammeter to measure saw blade power input, heat-treated alloy steel gearing and drive shafts, and large ways

Retrieving Mechanism Improves American Broaching Machine

American Broach & Machine Co., Div. of Sundstrand Machine Tool Co., Ann Arbor, Mich., has improved its Model T-24 three-way broaching machine by the addition of a hydraulically operated broach retrieving mechanism, thus permitting the operator to have both hands free for manipulation of the machine. Retrieving mechanism is mounted above the machine column, having its own slide and hydraulic cylinder, controlled and timed to operate in proper relation to the main operating cylinder.

In operation, the part is loaded onto the work bushing and the machine cycle started by an operating lever. The retrieving head carries the broach down through the work and into the pull-head. The main ram then automatically begins downward travel, pulling broach through the work. At the end of the stroke trip levers in the work table eject the



work and the machine slide begins the return stroke. At the end of this stroke the broach is picked up by the retrieving head and automatically carried back to the starting position. Once the machine is loaded and the cycle started, operation is automatic

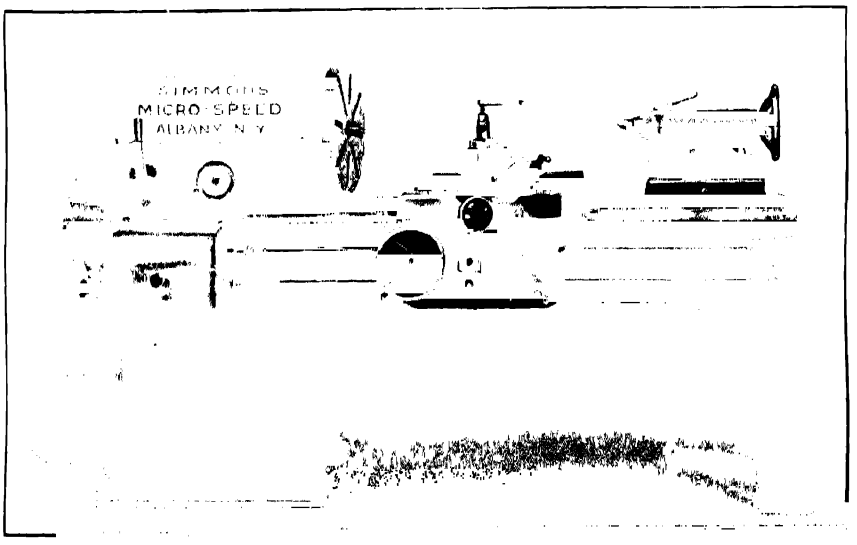
'Micro-Speed" Drive of Simmons Heavy-Duty Lathes Provides 1,000 Speeds Without Gears or Clutches

Maximum flexibility of spindle speeds without any gears or clutches is achieved through the use of the "Micro-Speed" drive on a new line of heavy-duty lathes developed by Simmons Machine Tool Corp., Albany, N. Y. This drive, installed in the cabinet-type leg provides a virtually unlimited variation of spindle speeds by finger-tip control. Only a slight twist of the handwheel on the headstock gives a wide range of speeds. Change is instantaneous.

Headstock spindle is mounted in Timken precision tapered roller bearings. It is driven through multiple V-belts from the "Micro-Speed" drive unit, eliminating all speed-changing gears. Motors are integral with this unit itself.

Lathe bed is of semi-steel. Heavy sidewalls with double-walled cross girts add to rigidity. Gears in quick-change gearbox, quadrant, end gearing, apron and all feed mechanisms are accurately cut from forged steel blanks. A separate leadscrew and feed rod are provided to preserve accuracy of the leadscrew, which is in use only when cutting threads.

This lathe is built in 16- and 12-in. sizes in the style illustrated, and in 18- and 20-in. sizes of an extra heavy duty model. Specifications, respectively, swing over ways 16, 18, 18 and 20 in., swing over carriage, 11, 13, 14 and 15 in., distance between centers on 6-ft. bed, 30, 30, 28 and 28 in., weight 3,300, 3,500, 4,300 and 4,600 lb.



Pipe Gasket Replacement Simplified With "Flange-Jacks"

Replacement of gaskets in flange pipe lines is claimed to be done faster, easier, more safely and more economically with the use of a pair of "Flange-Jacks" introduced by Garlock Packing Co., Palmyra, N. Y. With these jacks, pipe joints are claimed to be opened quickly even



when the working space is cramped, without damage to flange faces.

As the jack screws are tightened the flanges are separated gradually and evenly. There are no sparks caused by hammer blows, chisels or wedges, and no resulting vibration in the pipe line. After the new gasket is applied the joint is closed as easily as it was opened. Bolt holes are in perfect alignment and the gasket is properly positioned. There are no wedges to fly, and no jerking of the pipe which may cause leaks at other joints.

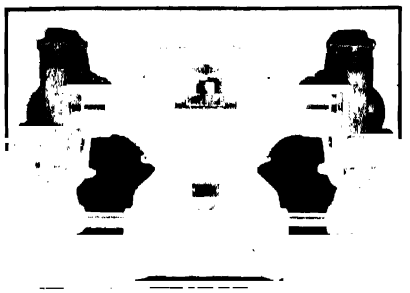
Jaws of these tools are heavy one-

piece steel forgings Points of the steel screws are case hardened "Flange-Jacks" are available in three sizes for pipe sizes under 2 in, for standard flanges from 2 to 20 in inclusive, and for standard flanges from 14 to 48 in inclusive

"Thor" Electric Bench Grinders Built for All-Round Service

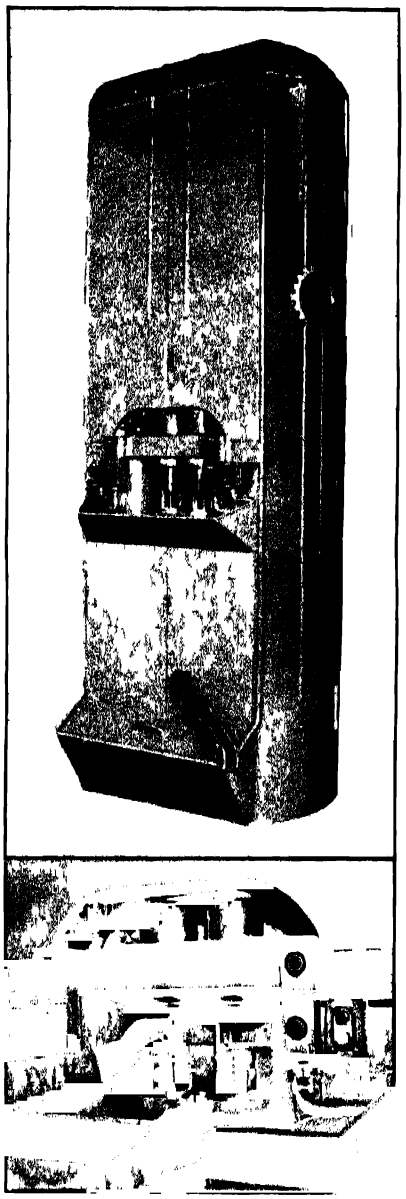
Three new "Thor" electric bench grinders developed by Independent Pneumatic Tool Co, 610 W Jackson Blvd, Chicago, Ill, have been substantially built for all-round service in grinding, buffing and wire wheel work The 6-in light duty (B-66), the 6-in heavy duty (B-6), and the 7-in heavy duty (B-7) all have completely enclosed ball bearing motors

All sizes are provided with adjust-



able tool rests and permit attachment of safety glass eye shields Wheel guards on the Models B-6 and B-7 are extra heavy and are of the enclosed type with chutes Models B-66 and B-6 are of the split-phase start, induction-run type while the Model B-7 is of the capacitor-start capacitor-run type with an oil-filled condenser in the base

Greater Accuracy in Finishing External Spur Gears Achieved by American Broach & Machine "Gearbroacher"



American Broach & Machine Co Div of Sundstrand Machine Tool Co Ann Arbor, Mich, has developed a machine for broaching external teeth of spur gears which is claimed to achieve greater accuracy and higher production than theretofore possible Known as the "Gearbroacher," this machine broaches every tooth in the gear at a single stroke and allows for individual sharpening and adjustment of each broach which cuts only a single tooth space

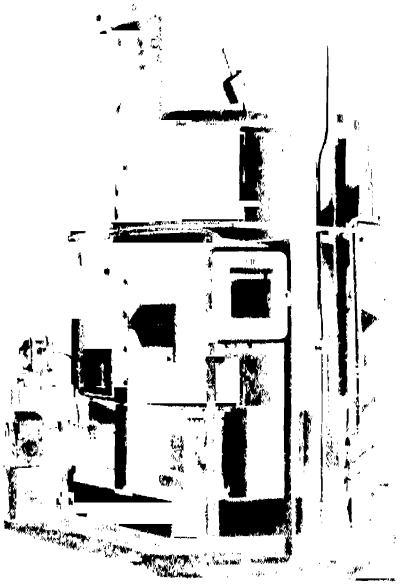
Machine itself is built of a cylindrical welded steel column which provides greater rigidity than is usually found in square or rectangular columns Two chambers are provided in the front section of the column one below the work table and one above The one above is provided with a crosshead of considerable span which is accurately machined and fitted into hardened and ground way caps the way caps being bolted on the scraped surfaces in the column proper Crosshead is on a common center with ways without any overhang The lower chamber contains two cylinders one on each side of the broach elevator These cylinders receive their pressure on the bottom thus using the full piston area when cutting Cutting stroke of the machine is on the up stroke The two cylinders are suspended from a ground steel work plate This construction eliminates packing glands thus eliminating packing leaks and also providing a machine that only has one packing gland on the low pressure side of the hydraulic circuit

Crosshead is hollow, allowing two tubular members to pass through it and through the automatic pull head to the master work head These two members support the master work head, taking most of the pressure exerted against it by the broaches They also serve for a lubricant passage as lubricant is forced through these tubes at a high pressure, with openings in the master work head to give positive lubrication to each tool Machine shown is arranged for broaching two gears at a time, there being two complete sets of tools and fixtures

Rear of the machine houses the electric motor, hydraulic pumping unit, hydraulic circuit and hydraulic valves Oil reservoir is in the lower part of the column with the motor above, all accessible through a rear door Machine is provided with a sight oil level Filling of oil reservoir is through rear door Machine is equipped with electrical control, permitting it to operate on a full-automatic cycle for continuous operation or on a semi-automatic cycle Machine shown is known as No 2 "Gearbroacher and is made in tonnage capacities of 8, 12 and 16 tons

Mahr Heat-Treating Furnace Uses Center Firing Principle

A new type of rotary forging and heat-treating furnace developed by Mahr Mfg Co Div of Diamond Iron Works Inc Minneapolis Minn claims several advantages through the use of a single burner center firing principle This burner located at the bottom of the hearth fires up



through a long combustion cone of special design This cone insures that the products of combustion come into equilibrium before coming in contact with the steel thereby minimizing scale and decarburization

The center firing principle is also said to provide a furnace free from cold spots, and to make possible close control over the furnace atmosphere Furnace can be equipped with full

Carboloy Announces
5TH PRICE REDUCTION

Plus New "Universal" Standard Tool For 80% of all Turning, Boring, Facing Job

Since the year when Carboloy tools were first introduced it has been the expressed aim of Carboloy Company to pass on to industry savings resulting from increased consumption and manufacturing efficiencies. As a tangible result of this policy, five major price reductions were put into effect between 1929 and 1939.

For a number of years, however, we have realized that if our ultimate goal of reducing the price of Carboloy cutting tools to a level that would make them available for the widest possible use, mass production methods of manufacture, through greater standardization, would have to be effected.

Towards this end one of our major activities has been to determine the minimum number of grades and the simplest line of tools that would be applicable to a substantial majority of carbide tool applications.

New $1,000,000 Plant Part of Program

Concurrent with this we inaugurated a long range program of manufacturing development to establish maximum efficiency for standardized production. This culminated in the expenditure of a million dollars on a new plant and equipment completed last spring, having a production capacity of ten times the amount of cemented carbide then consumed by industry, with provisions for expanding metal production to many times that amount.

Mass Production of Standard Tools Now Possible

Today we are happy to announce that this program has been completed. One of the outstanding results of this program now made available to industry is a line of standardized tools at prices that would have seemed beyond the realm of possibility only a few years ago. Indicative of the extent to which standardization has been developed is the fact that these tools—covering 80 per cent of all carbide tool requirements—comprise but five styles in only three grades—two for cast iron, and one for steel.

General Price Reduction on Carboloy Metal

A further result of this standardization program is that—because of the anticipated wider scale use of carbide tools—the cost of producing basic cemented carbides can be reduced to such an extent that we are able to announce the sixth general price reduction on carbide metals. This affects special tools, dies for working wire, bar, tubing and sheet metal, Carboloy wear-resistant inserts, etc., in proportion to the amount of Carboloy metal used in each product.

CARBOLOY COMPANY, INC., DETROIT, MICH.

CHICAGO • CLEVELAND • NEWARK • PHILADELPHIA • PITTSBURGH • WORCESTER, MASS.

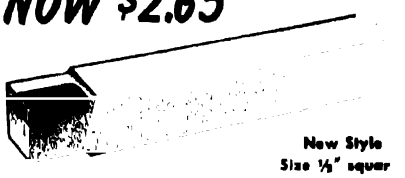
Canadian Distributor: Canadian General Electric Company, Ltd., Toronto

✓ Check These NEW Standard Tool Prices Against Any Other Cutting Alloy!

(Three styles illustrated)

~~$6.82~~

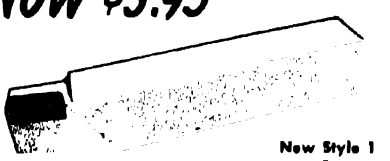
NOW $2.65



New Style
Size ½" square
(⅛ x 5/16 x ⅜ Carboloy Tip

~~$8.66~~

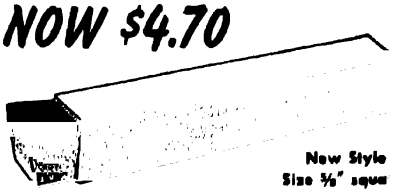
NOW $3.95



New Style 1
Size ½" square
(½2 x ⅜ x ¾ Carboloy Tl

~~$9.58~~

NOW $4.70



New Style
Size ⅝" square
(½2 x ⅜ x ⅝ Carboloy Tl

ALL TOOLS GROUND READY FO USE (STEEL CUTTING TOOLS INCLUD GROUND-IN CHIP BREAKER)

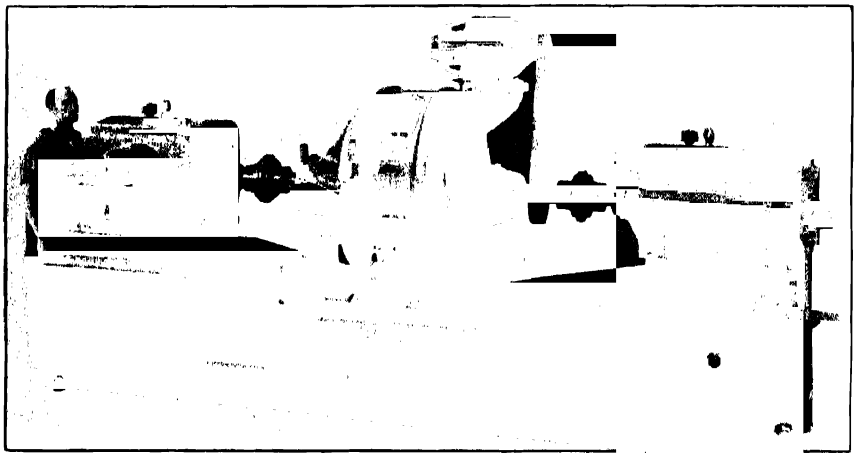
Write for New Price Sheets

CARBOLOY

automatic temperature control and with an individual low pressure blower to make it a self-contained unit. Positive pressure within the furnace is maintained by an automatic "Vent-O-Matic" stack damper.

The rotary table is gear driven through a variable-speed transmission. Furnace is equipped with an improved type of sand seal having filling chambers to maintain sand seal depth. A special type of door equipped with air curtain protects operator from heat. Heavily insulated throughout and supported by a rugged steel framework, the furnace is manufactured in hearth diameters ranging from 4 to 9 ft., for operation on either oil or gas, at temperatures from 1,400 to 2,500 F.

Oilgear Two-Way Variable Displacement Pumps Developed for Use With Pushbutton Control

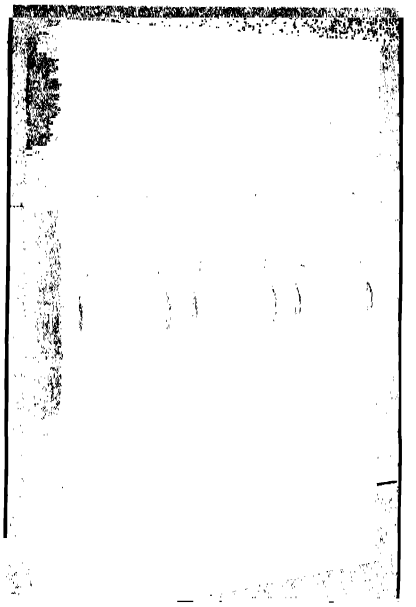


Two-way, three-position, variable displacement pumps have been developed by The Oilgear Co., 1302A W. Bruce St., Milwaukee, Wis., especially for use with remote pushbutton control. Available in sizes from 2 to 150 hp., these Type DX pumps are of the heavy duty, radial rolling piston type.

Practically each pump size is available with internal mechanisms for normal working pressures of 1,100, 1,700 and 2,500 lb. per sq.in. and for peak pressures up to 3,000 lb. per sq.in. All pumps are arranged for flange mounting to a separate reservoir base, or with an integral reservoir. They are equipped with built-in auxiliary gear pumps for supercharging the high pressure unit, for operating the pump control mechanism and for auxiliary purposes. Also included are a gear pump relief valve, dual reverse flow high pressure adjustable relief valves, and two-way automatic suction and discharge valves integral with the pump case.

Compact, integral control makes it possible to reverse the oil flow direction and also to select the neutral position from a remote pushbutton station, or by means of switches. Since oil flow is reversed in the pump, no external control valves are required. Illustrated is the Type DX-15025 pump in combination with a Type C15025 pump on a large reservoir base direct connected to a double-end 250-hp. d.c. motor. These units provide a combined delivery of 50,000 cu.in. of oil per min. at peak pressures up to 3,000 lb. per sq.in. for operating a 150-ton high speed hydraulic deep-drawing press having a 60-in. stroke.

These DX pumps are now standard equipment on all Oilgear broaching machines. Ease of operation, accurate control of volume, smooth acceleration and deceleration of oil flow, automatic protection against overload and automatic lubrication of working parts, make these units especially suitable for operating push and pull broaching machines, and for driving forming, assembling, forcing, broaching, extruding and speed presses.



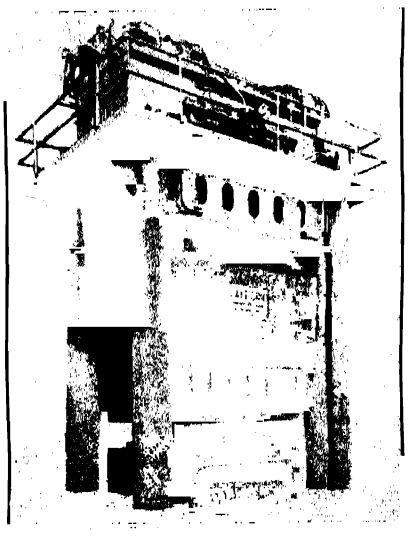
Two-in-One Steel Lockers Require Less Floor Space

Two-in-one steel lockers offered by Penn Metal Corp. of Pennsylvania, 36 Oregon Ave., Philadelphia, Pa., have been designed especially for use in cramped quarters. Illustrated is a group of three lockers which afford ample accommodations for six persons.

Each locker is 15 in. wide, 21 in. deep and 73½ in. high, and is divided into two coat compartments, each of which is 7½ in. wide, 21 in. deep and 54 in. high. The two hat compartments are each 15 in. wide, 21 in. deep and 9 in. high.

Frame members are spot welded for strength and rigidity. All nuts and bolts are cadmium finished to resist corrosion. Rubber bumpers are used at contact points to prevent doors from banging.

1,700-Ton Double-Slide Hydraulic Press Manufactured by Lake Erie Engineering



Claimed to be the largest of its type made in America, a 1,700-ton double-slide hydraulic press has been developed by Lake Erie Engineering Corp., Buffalo, N. Y. This press is designed to exert a pressure of 900 tons on the blank-holder and 800 tons on the main ram.

One of the operations successfully performed on this press is the production of steel bath tubs, illustrated. In this application the high hold-down pressure eliminates wrinkling of the edges of the sheet when forming the part without the use of draw beads. Tubs are formed cold from 65x79-in. 14-gage sheets in a single operation.

Press has a speed of several cycles per minute. Typical installation is with top of bed located at floor level. Vertical columns are covered by flex-



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ible fabric boots, giving protection against abrasive dust resulting from dressing dies.

Entire press is self-contained with pumping unit mounted on top. Operation is controlled by centrally located pushbuttons. Adjustable pressure control of blank-holder and main ram is provided. Daylight opening is 98 in., and stroke is 37 in. Cushioned bed measures 160x106 in.

"Flextite" Leak-Stopper Requires Few Seconds to Set

The Flexrock Co., 2300 Manning St., Philadelphia, Pa., has developed a new active ingredient which, used in "Flextite," brings its activity down to a matter of seconds. This improved compound is used with ordinary



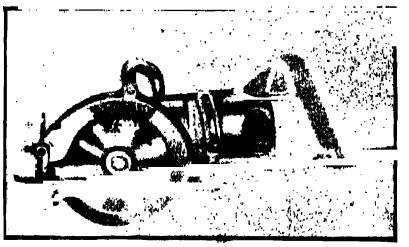
portland cement. In use it is forced against water pressure, held there a few seconds, and the leak is stopped.

"Flextite" is claimed to be invaluable for stopping leaks in dams, retaining walls, dykes, concrete structures holding water at irrigation plants and reservoirs, and in concrete tanks and other such places. It is also used for waterproofing and damp-proofing cellars, basements, pits, tanks and similar locations.

6-In. Portable Skilsaw Designed for Heavy Duty

The Model 67 portable electric saw has been developed by Skilsaw, Inc., 5022 Elston Ave., Chicago, Ill., especially for heavy-duty service. This 6-in. saw is more compact than previous models and is said to be ideal for general remodeling work and for intermittent maintenance sawing.

This machine may also be used with abrasive disks for scoring tile, concrete, etc. It cuts to a depth of 1⅞ in., and will rip and cross-cut hard wood up to 1 in.; cross-cut dressed pine lumber up to 2 in., and bevel cut lumber 1 3/16 in. thick at 45 deg. Blade has a free speed of 3,400 r.p.m., and is protected by an automatic telescopic guard that ro-

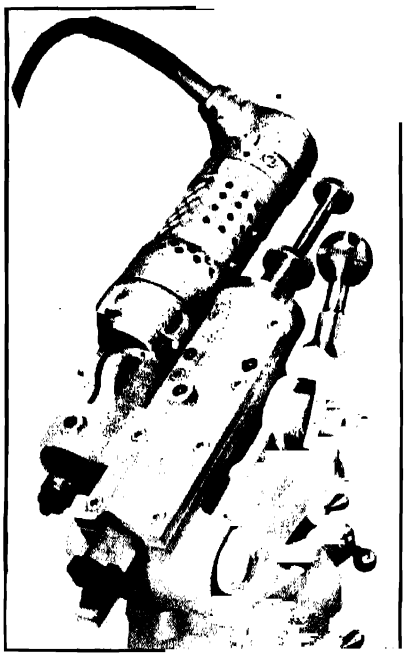


tates on ball bearings. Base is easily adjustable for depth and bevel cutting. All moving shafts are mounted on ball bearings for quiet operation and long life. Tool is 15½ in. long and weighs only 11½ lb.

Superfinishing Attachment Surfaces Small Diameters

The Size O light duty superfinishing attachment offered by Foster Machine Co., Elkhart, Ind., has been designed for mounting on the lathe compound or cross slide for superfinishing fractional-inch diameters.

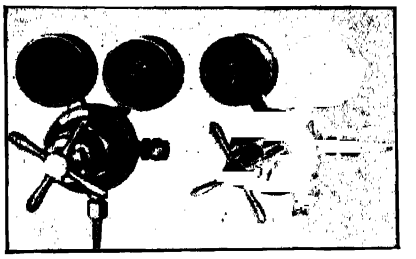
Stone pressure is provided by a very sensitive, easily adjusted spring.



Stone is retracted by a lever which does not disturb stone setting. Oscillation is imparted to the stone in a straight line movement by small gearmotor.

Three Single-Stage Regulators Offered by Linde Air Products

Linde Air Products Co., a unit of Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y., has added three single-stage, general service regulators to its Oxweld line of welding and cutting apparatus. These regulators, the R-80 oxygen regulator for delivery of oxygen at working pressures up to 200 lb., the R-81, its companion acetylene regulator, and the R-82 fuel gas regulator, feature simplicity of design and reliability of operation. They are strongly built and are designed to give dependable performance in all welding, cutting, and deseaming operations where simplicity of construction and large ca-



pacity are demanded, but where the refinements of two-stage regulators are not required.

The R-80 and R-81 regulators are of the stem type, the valve closing with incoming pressure, thus assuring positive seating action. Materials used for valve seats are selected for efficient service and long life. Passageways are of sufficient size to permit unrestricted flow of gases. In addition, the R-80 oxygen regulator has a special inlet screen formed of a double thickness of fine mesh to filter out dirt and foreign particles. Since the R-80 and R-81 have only a few working parts, the occasional maintenance which may be required can be performed quickly and inexpensively.

The R-82 fuel gas regulator also is of the stem type and is for use with various other gases, such as Pyrofax, propane, and butane. It has the same operating advantages and construction features as the R-81 acetylene regulator.

Additional Filter Cartridge Made For Basic Respirator

American Optical Co., Southbridge, Mass., has made available another filter cartridge for its versatile R-1000 respirator, thereby providing five



interchangeable types of protection in one basic unit. The new filter gives protection against toxic dusts formed by crushing, grinding and abrading such solids as lead, cadmium, arsenic, chromium, manganese, selenium, vanadium and their compounds.

The other four filter cartridge previously available provide protection against: (1) pneumoconiosis-producing dusts like quartz, asbestos, ores, coal, flour, etc.; (2) low concentrations of fumes, vapors or gases encountered in paint spraying, and other light organic vapors; (3) low concentrations of acid fumes and gases; (4) low concentrations of combined acid-organic gases and vapors.

Post Transparent Medium Takes Pencil Like Ink

Ink-like opacity from hard drawing pencils is provided by "P.T.M." transparent medium developed by Frederick Post Co., P. O. Box 803, Chicago, Ill. This medium, not a tracing cloth and not a vellum, is said to produce ink results at pencil speed.

Blueprints made from drawings produced from ordinary hard drawing pencils on this new medium have a solid background and sharp white lines. On "Blacline" prints the detail is solid and sharp, with the background uniformly white Both the opacity of the pencil detail due to the drawing surface and the extreme transparency of the drawing base contribute to the superior printing results

Further advantages include exceptional strength and body. Compared to the best vellums it has from 2 to 10 times the wet tensile strength and from 10 to 50 per cent greater tear and burst resistance. The reverse side is dust protected by a glazed finish similar to the reverse side of tracing cloth. The surface is moisture-proof, and cost is less than one-third of the price for tracing or pencil cloth.

Standard rolls are 20 yards long and 30, 36, 42 or 54 in. wide. The medium is also available in plain sheets or printed.

Two Insulated Welding Gloves Announced by American Optical

Two welding gloves, insulated for heat protection and reinforced for long life, have been made available by American Optical Co., Southbridge, Mass.

The TX100 glove is said to present a new idea of comfort, quality, workmanship and wear. Made from good grade chrome tan horsehide to a "gun-cut" pattern, this glove has no seams exposed to active wear. All are at the back of the fingers, except at the base of the second and third fingers, and these seams are welt reinforced. Thumb and index finger are also reinforced. Back of the

Advertisement

Manufacturers Look to Steel Warehouses for Quick Defense Requirements

Suddenly spotlighted by snowballing demands for adequate defense of America, machinists, tool craftsmen, and engineers are keenly aware of their crucial position in American industry. Without heroics, they realize that a good lathe hand is now much more important in the preservation of the American way than a fully trained soldier.

And, like most Americans, those employed in the metal working field are straining mightily to fill the gap between materials "on order" and equipment ready for action.

But the hurly-burly and press of emergency often defeats its own end. The sudden transition from idling along at ¾ speed to wide open throttle creates new problems of steel supply and delivery. Ultra-rigid specifications, too, must be met and mastered.

As in World War I, when Joseph T. Ryerson & Son, Inc. received the War Department award for distinguished industrial service, Ryerson is fully equipped to handle quickly and efficiently steel demands for national defense.

Ryerson certification of steel for quality—a vast range of stocks for quantity—and immediate shipment for speed, will help you win your production war without waste. (See Ryerson ad below.)



Meet Government Specifications with RYERSON CERTIFIED STEELS

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Under the Ryerson Certified plan, you get steels made to narrow, close-range specifications. You get accurately identified steel of known analysis . . . steel you can depend on to meet government requirements. It is also easier to pass inspection on the finished job if Ryerson Certified Steel is used. All Ryerson Steels are closely controlled as to chemical content, accuracy and finish without the slightest increase in cost to you. A special quality control plan on Alloy Steels assures uniform heat treatment response.

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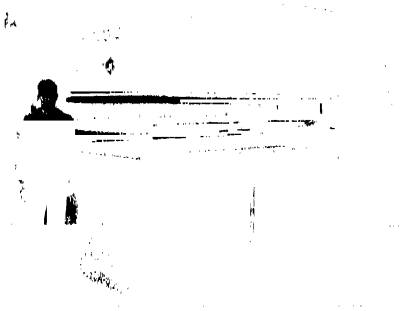
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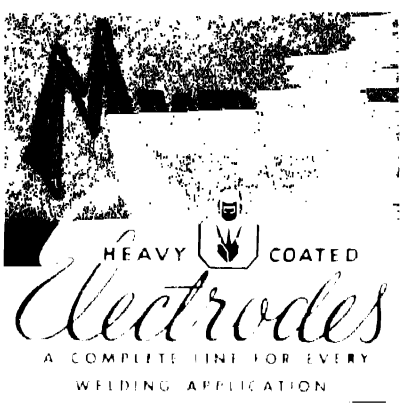
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Ask to have Murex Electrodes demonstrated on your high strength—low alloy applications A note to the nearest M & T office will bring a representative promptly

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So San Francisco • Toronto



glove is one piece removing any chance of seam breakage under extreme heat Inside is insulated with wool

The other glove of slightly different design is made on the gun-cut pattern from carefully selected chrome tanned horsehide with a seamless palm All seams of this No 3015 glove are at the back of the fingers where they are not exposed to wear, except for welt-reinforced seams at bases of second and third fingers Differences in design from the No TX100 glove are that the thumb and index fingers are reinforced and that the back is reinforced with an outside patch

NEW MATERIALS

Special Finishes Developed For Infra-Red Baking

A line of finishes developed especially for use with infra-red baking equipment has been announced by Ault & Wiborg Corp Dana & Thomas Aves Cincinnati Ohio Formulas include both under coats and top coats in a full range of plain colors with no limitation as to lustre A hammered effect and various wrinkle finishes are also available All finishes are claimed to maintain satisfactory characteristics of hardness flexibility durability and adhesion

In many cases baking time is cut to one-half and in several instances to one-third by the use of these finishes in conjunction with infra-red drying They can be used successfully on such articles as household appliances auto parts cabinets and other metal products requiring an excellent finish

Superior Physical Properties Claimed for Aluminum Alloy

Exceptionally good physical properties are claimed for the T–1" aluminum alloy developed by National Bronze & Aluminum Foundry Co E 88th & Laisy Ave Cleveland Ohio Among these properties are tensile strength up to 33 000 lb per sq in without heat-treatment good machineability and ability to be welded without loss of physical properties

Foundry practice is virtually the same as for other aluminum alloys Since no quench is used castings are free from internal stresses For the same reason the alloy can be welded without loss of physical properties

Percentages of ingredients in "T–1" alloy are approximately as follows copper 2 0, tin 1 5, magnesium 0 7, zinc, 1 0, titanium 0 2, chromium 0 2, and the balance aluminum Specific gravity is 2 78 Ultimate strength ranges from 30 000 to 33,000 lb per sq in, yield strength (elastic limit) from 16 000 to 25,000 lb per sq in percentage elongation from 6 to 10 and Brinell hardness from 60 to 78

TRADE PUBLICATIONS

ALLOYING METALS A 16-page booklet which describes the effects of alloying elements, their characteristics applications, and heat-treatment has been published by the International Nickel Co, Inc 67 Wall St, New York N Y

BRACING MATERIALS Signode Steel Straping Co, 2600 North Western Ave, Chicago, Ill has issued a four-page illustrated pamphlet which describes the use of steel strapping as an effective method of protecting carloads of cartons, boxes or bags in transit

CLEANERS A four-page folder circulated by Homestead Valve Mfg Co Coraopolis, Pa, illustrates and describes the uses of steam cleaners

CONTACTORS Westinghouse Electric & Mfg Co, East Pittsburgh Pa is circulating a four-page illustrated booklet which describes a heavy duty d c magnetic contactor

CYLINDERS AND TANKS Four-page bulletin No 308 circulated by Wm B Scaife & Sons Co Oakmont Pa tells of a method to reduce maintenance cost of cylinders and tanks

FACING ALLOYS Catalog No 72 circulated by Wall-Colmonoy Corp 636-7 Buhl Bldg, Detroit Mich provides information regarding hard facing alloys and overlay metals for maximum resistance to wear and corrosion

FANS Four-page bulletin No 206 circulated by Autovent Fan & Blower Co 1805-27 N Kostner Ave Chicago Ill offers diagrammed illustrations which indicate the operation and application of All-Vent Fans

FOUNDRY EQUIPMENT Catalog No 60 circulated by the American Foundry Equipment Co Mishawaka Ind contains 12 pages of illustrations and descriptions of the entire line of products manufactured by the company

HEAT EQUIPMENT York Oil Burner Co Inc York Pa provides two specification sheets which describe the construction and operation of high pressure boiler burner units

METAL THICKNESS A test of electro-deposit thickness of zinc, cadmium, tin and copper is described in a new technical service manual issued by E I du Pont de Nemours & Co, Wilmington, Del

MOTORS A two-page illustrated leaflet No F-8533 is offered by Westinghouse Electric & Mfg Co, East Pittsburgh Pa, to describe constant

speed direct current motors in either shunt or compound type.

MOTORS A four-page illustrated leaflet No. 3105, which describes totally-inclosed, fan-cooled squirrel cage motors is being circulated by Dept. No. 7-N-20 Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa

PUMPS Catalog No. 939 issued by George D. Roper Corp., Rockford, Ill., tells a non-technical story of uses, installations, etc. of pumps

PYROMETERS Leeds & Northrup Co., 4934 Stenton Ave., Philadelphia, Pa., has published Broadsides Nos. N-33 and T which provide information regarding pyrometers and heat-treating furnaces.

SAFETY CLOTHING Industrial Gloves Co., 900 Garfield Blvd., Danville, Ill., describes and gives prices of its industrial clothing in an 18-page booklet

SAFETY SHOES Catalog No. 9, issued by Lehigh Safety Shoe Co., Inc., Allentown, Pa., contains a "Safety Shoe Buyers' Guide" section which explains safety shoe construction features.

SEALING B. F Goodrich Co, Akron, Ohio, has issued a new catalog section on Plastikon rubber putty, a material which has industrial and construction application because of its ability to maintain air-tight and moisture-proof seals

SHAFT MACHINES Catalog No 40 circulated by Stow Mfg. Co, Inc, Binghamton, N. Y., describes and illustrates various flexible shaft machines, hand pieces and angle heads, grinding wheels and buffs

STEEL VALVES A 306-page book No. 40-S, devoted exclusively to steel valves and fittings has just been issued by Crane Co, 836 S Michigan Ave, Chicago, Ill

SWITCHES Micro Switch, Freeport, Ill., describes in Data Sheets Nos 11 and 12 a compact, low-priced switch, for use where roller equipped pivoted arms are desired.

TAPS A four-page pamphlet, which illustrates, gives sizes and prices of precision taps is offered by Threadwell Tap & Die Co., Greenfield, Mass

TOOLS Catalog No. 40 published by the Ready Tool Co., Bridgeport, Conn., contains a complete price list of ball bearing and high speed centers.

WEIGHTS AND DATA A book containing practical and complete tables of weights and data on copper, brass and bronze products has been published by Revere Copper & Brass, Inc., 230 Park Ave., New York, N. Y.

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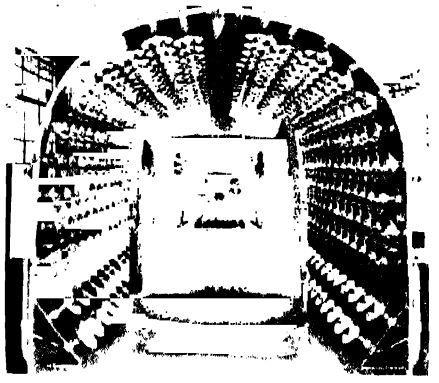
Cleveland, Chicago and New York

Columbia Steel Company, San Francisco, *Pacific Coast Distributors* — United States Steel Export Company, New York

UNITED STATES STEEL

AMERICAN MACHINIST

October 2, 1940



Hot Lamps—*Industry turns to the red end of the spectrum to speed the drying of metal finishes*

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A New Service

FOR YOU IN

The Metal Show Number

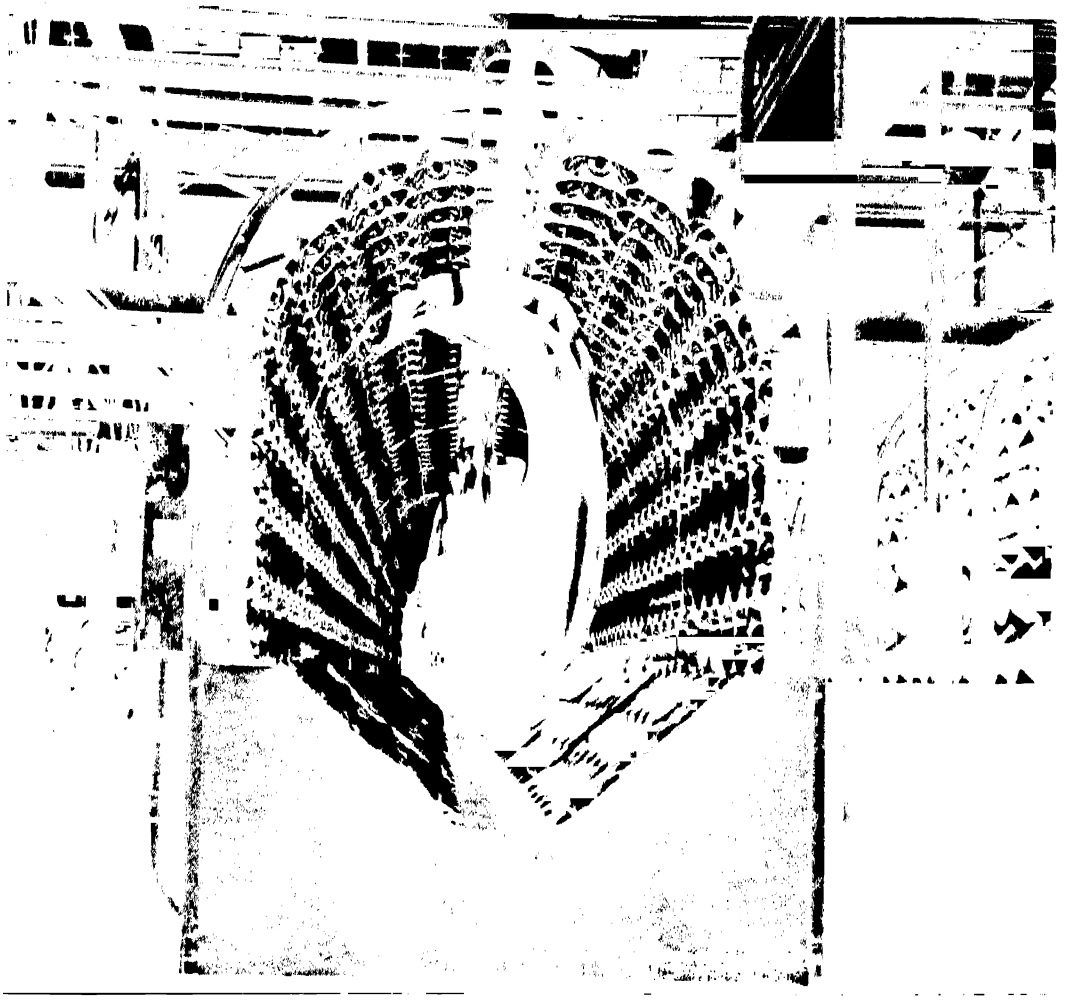
★

● The current defense program, piled on top of normal heavy business, has forced many metal-working companies to seek outside help in producing tools and dies, forgings, castings, stampings, etc., as well as for contract machining, heat-treating, welding and finishing. American Machinist is now compiling a detailed list of companies with specialized facilities for handling contract work. This, the first such directory to be published, will appear in October 16 Metal Show Number, as

A DIRECTORY OF CONTRACT-WORK FACILITIES

★

Watch for your copy—it will save you time and trouble.



Ford fender finish is quickly dried by passing the parts through a lamp lined tunnel

Infra-red in industry

BY JOHN SASSO

Radiant heat from the sun keeps this planet habitable. The same phenomena finds new application on metal products

RADIANT ENERGY produced by short wave lengths in the infra red range of the spectrum, was applied a few years ago by the Ford Motor Company to the drying of automobile body finishes. Since then electrical infra red drying has attained considerable acceptance. It is now being used for drying prime and finishing coats on auto bodies, enamel on parts such as steering columns, lacquered surfaces, paint on castings, enamels on die castings, for softening plastic sheets prior to punching and for baking transformers and armatures.

Advantage has been taken of radiant heat in conventional gas fired baking ovens for years. However, in the last few years, new electric and gas infra red heat sources have been developed. Widespread attention has been given electrical sources of this energy because of the high color temperature and efficiencies obtained with incandescent lamps, and because the baking set up is simple, even though it is sometimes difficult to place the full surface of the part being dried in front of the rays. In complicated assemblies, having shadows and inaccessible surfaces, con

vection oven baking is usually the solution But some finishes cannot be successfully dried by convection and conduction must be used

In non technical terms infra red red energy is similar to what we know as light, except that infra red is longer in wave length than visible energy The fundamental principles parallel those of lighting However, sources of radiant energy operate at a lower temperature than those used for light

Another difference lies in the amount of energy required, in radiant heating, densities on a surface may run as high as 1 000 watts per sq ft , the same surface would be brilliantly illuminated with 50 watts per sq ft In the radiant spectrum, wave lengths are in that portion over lapping light wave lengths and extend from 0 6 to 0 7 millionths of a meter to five millionths of a meter Commercial sources of radiant energy emitting most of their energy in the wave-length of one millionth of a meter operate at 2,500 F By lowering the temperature of the source, the wave length is increased

Incandescent bulbs arranged in various ways, Fig 1 furnish the source of energy for infra red drying Both tungsten and carbon filament lamps are used Originally the standard lamp was 240 260 watts, recently tungsten lamps of higher capacity, 500 and 1,000 watts, have been announced for this process See Table I Maximum energy distribution of these lamps occurs at about 2,500 deg absolute, with wave lengths of about 11,000 to 14,000 angstrom units (0 0000011 to 0 0000014 meters long) depending on the type

Of the electrical energy input into these lamps, approximately 90 per cent is converted into heat waves which penetrate the surface and are reconverted into heat energy The reduced baking time thus obtained is not caused by catalytic action but by the attainment of a higher temperature in a short time This has been confirmed by tests made by the Glidden Company and the Pontiac Paint and Varnish Company Their conclusions were that an ordinary baking oven, operating under temperatures available from radiant energy, would produce the same results in the same time It follows that radiant drying is merely an effective method of getting heat into a paint film in a minimum of time

The surface with the highest reflection factor for infra red energy is gold plating, copper and silver plating are close to gold Alzak is also well suited for redirecting the near infra red energy Other materials such as chromium and aluminum are less efficient silver and copper tarnish quickly Gold plated reflectors are more stable than silver but they should be cleaned every six weeks when drying lacquer Efficient reflectors redirect the radiant energy so thoroughly that there is no sensation

TABLE I—AVERAGE WATT PER SQ. IN. ON WORK

	*Triangular banking of units **	*Rectangular banking of units **
250-watt drying lamps in 12 in reflectors, edges touching, 12 in. gold-plated from work	1 2	1 1
250-watt drying lamp in 9 in reflectors, edges touching, 12 in gold-plated from work	1 8	1 5
250-watt drying lamps in 8 in reflectors, edges touching, 12 in gold-plated from work	2 0	1 7
500-watt drying lamps in 12 in reflectors, edges touching, 12 in gold-plated from work	2 5	2 2
1000-watt drying lamps in 12 in reflectors, edges touching, 12 in gold-plated from work	5 0	4 4
Sunlight, summer at noon, sea level	0 7	

* See Fig 1

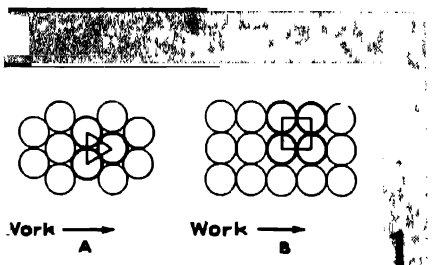
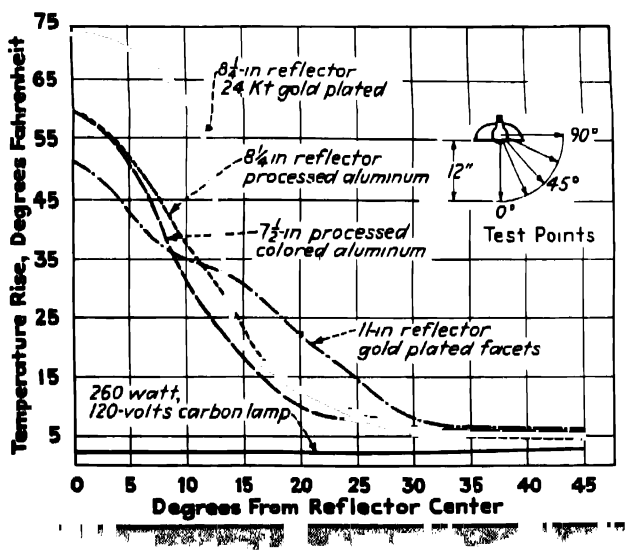


Fig 1—Of these two ways of arranging light units Method A gives fifteen per cent greater concentration and better energy distribution than Method B

Fig 2—Size and material of the reflector have a marked influence on the effectiveness of the heat source as shown by these curves

Fig 3 The type of reflecting surface and the angle of cut off determine the per cent of total radiation delivered to the working plane according to actual test



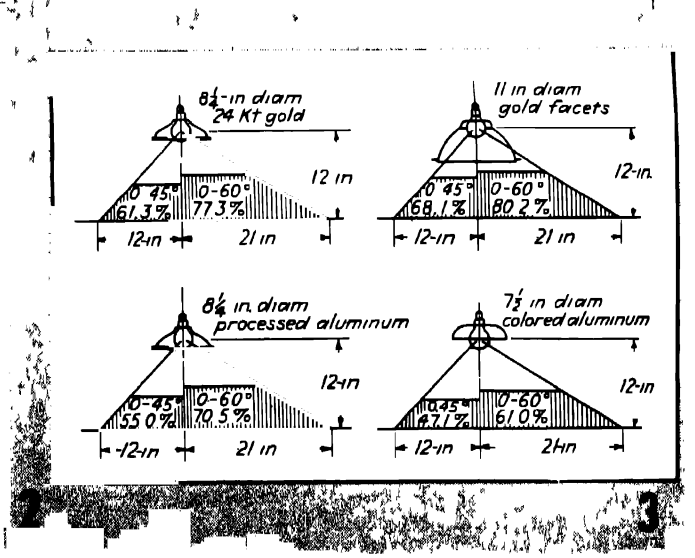


TABLE II — REFLECTION FACTORS OF PIGMENTS

PIGMENT	Wave-length (Angstroms) 6,000	9,500	44,000
Cobaltic oxide—steel gray	3	4	14
Chromic oxide—dark green	27	45	33
Lead oxide — yellow	52	—	51
Ferric oxide — red	26	41	30
Lead chromate—yellow	70	—	41
Zinc oxide — white	82	86	8
Lead carbonate —white	88	93	29

of heat near the reflectors even when they are operated in groups of hundreds

Tests indicate that a concentration of six watts per sq in on 20 gage black painted sheet steel will give a temperature of 500 F in five minutes while a concentration of two watts per sq in will give a temperature of only 220 F in the same time Concentration of energy depends on the wattage of the lamps as well as the design and spacing of the reflectors

The amount of heat at the surface of the part varies inversely as the square of the distance to the lamp In commercial practice this distance is only 6 to 18 in depending on the time the pieces stay under the lamp The design of the reflector is much more important than is the distance from lamp to surface

Tests conducted in the lighting laboratory of Commonwealth Edison on infra red reflectors indicate that reflector diameter is a factor in determining radiation density the solid angle subtended by a reflector is a factor with regard to glare and to percentage of lamp energy redirected to the working plane With a reflector which has a cut off below the filament center, glare in the eyes of adjacent operators is prevented to a considerable extent

From Fig 1, it might be concluded that the 8¼ in and the 11 in gold plated reflectors were about on a par but reference to Fig 2 shows that the total radiant energy delivered on the work by the 11 in reflector exceeds that given by the 8¼ in unit For any given lamp the total radiant energy delivered on the work may be greater for a smaller diameter reflector even though that reflector individually has the lower efficiency Thus, with the 11 in reflector made up into banks, the spacing ordinarily would be 12x12 in or 144 sq in per 260 watts whereas the 8¼ in reflector ordinarily would be mounted on 8½x8½ in centers corresponding to 72 sq in per 260 watts

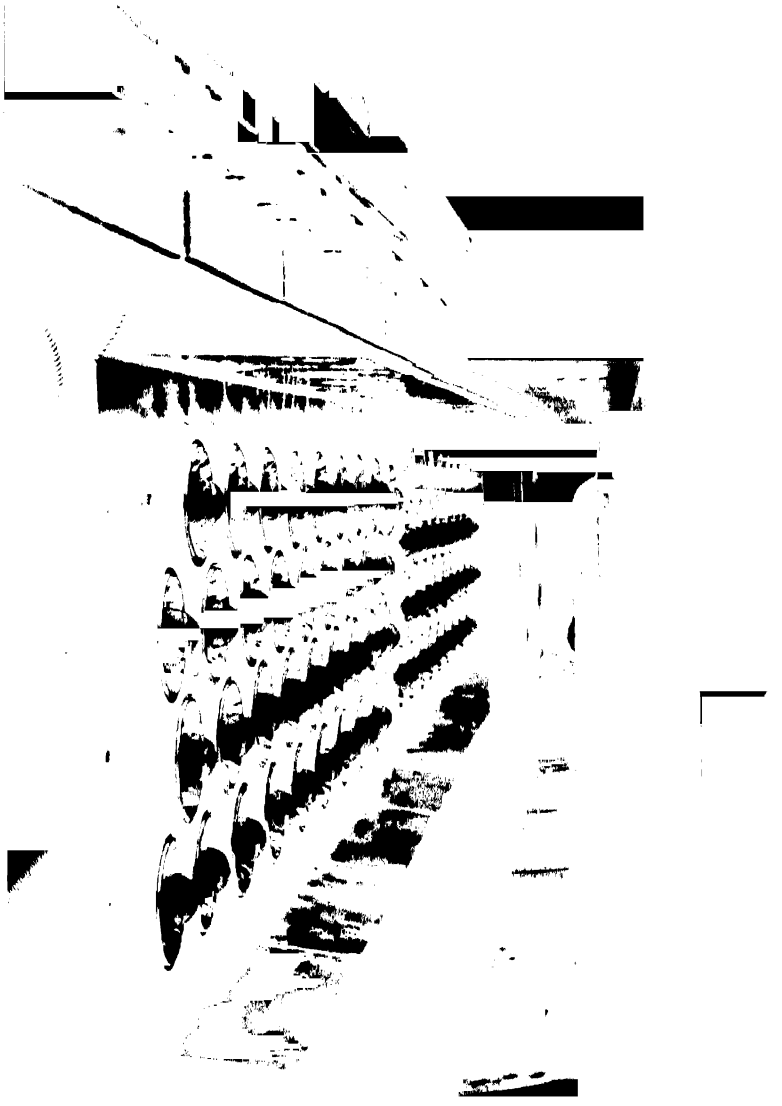
Higher reflection factors of the surface do not remain constant but change with the wave length of the infra red this variation is indicated for some pigments in Table II

Reflection factor or ability to absorb energy depends on the pigments and color Hence white and other light colored finishes cause more difficulty in getting the rapid baking desired for good production In one application where a high reflection factor was encountered the reverse side of the metal was heated drying the paint by conduction, as the bare steel effectively absorbed enough of the available energy to dry the finish

Red colors, next to white are the most difficult to dry because of their generally high reflection factor in the infra red range Blues and greens are good in absorbing radiation

Various colors on thin gage steel sheets have been tested White paint reached a temperature of 315 F in eight minutes while red, yellow and gray reached successively higher temperatures up to black which reached 460 F also in about eight minutes Aluminum paint reached only 250 F in the same time interval

Large mass with a limited surface presented to the rays will conduct heat away from the surface and retard drying This effect is useful when baking cores or motor armatures



The Steel Storage Pile Company uses a baking schedule under five minutes for polymerin finish with this radiant infra red installation

black indicate that thickness has an appreciable effect on the "heating-up" time. In four minutes a 14-gage panel reached a temperature of about 230 F. while a 20-gage panel, only about half as thick, reached a temperature of about 260 F. in the same time. In eight minutes the temperatures were 300 to 325 F., respectively. If baking time is long enough, the work is heated through, and from then on its thickness has no further effect. With finishes which have a short baking time, the thickness has a definite effect on the production rate since a large percentage of the total time is consumed in bringing heavier gages up to temperature.

Other factors which affect the rate of drying are: the specific heat and conductivity of the material; heat losses from low temperature radiation by the work; air currents or drafts; conduction to backing or supporting members; area presented as a "target" for the rays; film thickness and type of finish.

While the cooling effect of drafts should be kept to a minimum a certain amount of air movement is required to keep the volatiles from reaching inflammable concentrations. With proper technique there is no danger of explosion.

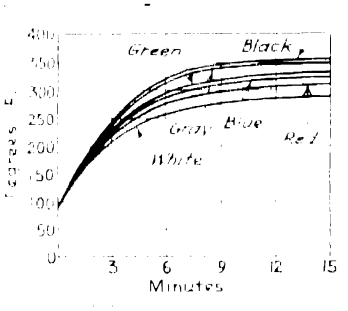


Fig. 4—The temperature reached during drying time varies with the color of the paint; these readings were on 22-gage sheet steel

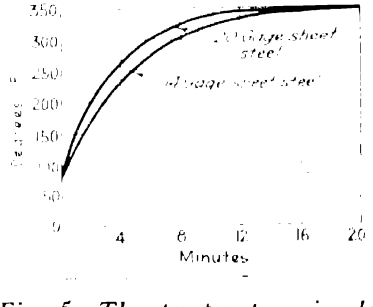


Fig. 5—The temperature is also affected by the thickness of the panel on which paint is applied; note the more rapid rise for the lighter material

TABLE III—HARDENING CHARACTERISTICS OF FINISHES

Material	*Baking Temperature*	*Comment*
Synthetic enamels; alkyd synthetic and urea-formaldehyde modified synthetics	250–350 F. (1.75–2.0 watts per sq.in.) 350–400 F. (about 2.8 watts per sq. in.)	Harden by polymerization and/or oxidation. Oil modified resin is used instead of an oil as the vehicle. Response to infra-red treatment depends on pigments and color.
Lacquers	100–150 F.	Harden by evaporation. Since they are dried at low temperature to avoid pinholing and budding no discoloration will occur. Formerly air dried because of the low temperatures, use of infra-red has proven a great time saver.
Wrinkle finishes	150–450 F.	More difficult to bake out because of the high temperatures required and longer time required for oxidation.
Japans		Baking japans have not proven economically feasible for this method of drying as the vegetable oils which they contain harden too slowly. Air-drying japans, however, offer no difficulty.

For parts having large surfaces it is necessary to present as much as possible of the total area to the energy source by proper lamp or conveyor arrangement. Parts with recesses may cause difficulty because they heat unevenly or because the radiant energy does not reach all the areas to be dried. Unusual or difficult applications of this sort must be solved by trial installation. In an electric auto parts plant, it was found that by rotating parts of irregular area under the lamps, synthetic enamels were dried satisfactorily in 10-15 min. instead of the 60 min. required by gas oven.

Air-dry finishes may be handled by infra-red drying at temperatures not exceeding 150 F. House paints and architectural finishes made with oleo-resinous vehicles do not behave satisfactorily with infra-red. Synthetic enamels and wrinkle finishes require higher temperatures but cause no particular difficulty. Temperatures as high as 600 F. have been satisfactory for baking wheel finishes. All synthetic enamels do not respond to infra-red drying to the same degree, as some tend to "yellow" because of the actinic property of the light.

Discoloration may occur if the temperature under the lamp is allowed to exceed the baking temperatures. Most of the organic pigments are sufficiently stable to be heated successfully, if careful control of temperature is exercised. Some finishers have found that the substitution of inorganic substances for organic pigments solves the problem of control.

Insofar as the other constituents of enamels are concerned, some of the resins in the finish may cause no particular trouble. See Table III. Speed of baking depends somewhat on the oils introduced to modify the resins; perilla and tung oil have been found to be satisfactory. Soya oil vehicles dry too slowly for the infra-red method.

Experiments in drying oil-base paints, similar to house paints were unsuccessful when application to farm equipment and to wooden toys was attempted. Oil paints and oleo-resinous materials in general cannot be baked rapidly enough under infra-red lamps because they require considerable oxidation.

A second article on "Infra Red in Industry" will appear in an early number

The Microscope as a Shop Tool—Correction

JOSEPH DAUBER, author of the recently published article, "The Microscope as a Shop Tool," has called to our attention two minor corrections. The sentence starting on line 15, column 1 (*AM*—Vol. 84, page 530) should read "In this case each numbered division of the scale is equal to 0.010 in. on the object, and the range of measure is 0.1 in. Each of these intervals on the reticle has ten subdivisions, which are not shown in the illustration."

Also, on page 532, the sentence starting on line 4, column 3 should read: "This 60-deg. reticle may be either spider threads, or lines engraved on a glass plate, at 60 deg. to each other."

Training in the small shop

BY E. G. MARSHALL ASSISTANT SUPERINTENDENT PITTSBURGH SCREW & BOLT COMPANY

Rarely is a shop too small or too busy for apprentices. If properly taught, boys can pay their way from the very start

IN PLANNING a training program, first let us study the finished product, the first-class skilled mechanic, before we decide how to teach a beginner When we build a die or machine we design the finished product, break it into small elements, then build it step by step We should do the same with our skilled mechanics

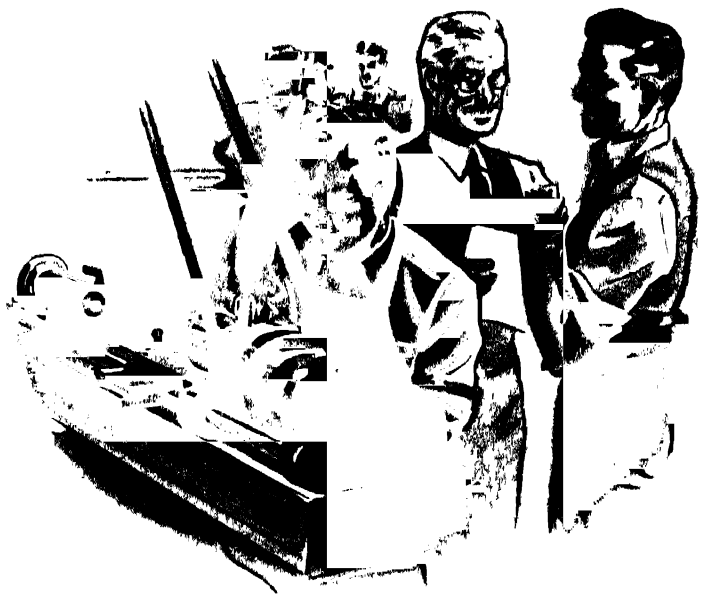
A skilled mechanic should know how to operate and care for most of the machines used by the trade He should have a broad knowledge of bench work He should be able to plan a new job so that each step will be done in proper sequence, in the least possible time, without wasted material or motion, with all work done accurately and neatly

When a man is promoted, he is advanced because of ability to get results more than for any other reason So let us agree that the basic cause for advancement is "getting results" Also let us agree that what we want to teach beginners is how to get results Then where we shall get our boys? We must bear in mind that only those who are naturally gifted as mechanics are to be selected I do not believe we should consider boys below the age of 18 or 19 Competition between mechanics is such that a boy without a high school education will be left behind From the master mechanic's viewpoint, the boy with an academic high school education lacks two essentials to starting an apprentice course He lacks the practical training of the trade school boy and the theoretical training of the college boy

The boy who has had a college training has shown that he has a good degree of intelligence Also in the engineering courses he has had a varied amount of shop work Training in the theory of mechanics makes him a better prospect for the machine shop than the high school boy When he starts in the shop, the theoretical training does not help him to get results at first But after he acquires some practical ability the theory helps him to advance faster His training in college shops is different from what he would get in industry The boy who has been to a private trade school or has had machine shop training in the high school has the practical but not the theoretical start to be an apprentice

There is no guarantee that the boy will succeed A trade is a guarantee only so far as receiving first-class mechanics' wages A man can marry and have a family and be respected in his community as a mechanic And using a mechanic's status as a base he can study and advance into other jobs During depressions when overhead is being cut he can go back to work as a mechanic

Now that we have decided what the finished mechanic shall be and what boy to select for training, let us determine what the training program shall be Let us remember that we are dealing with human lives, and that we may be the means of making many boys into failures or successes Let us not use the apprentice system as a means of getting a supply of cheap labor When we give our word to teach a boy a trade let us do it, and do it well Another thing to avoid is training the boy in only the work he has to do at the moment, with the hope he will not be able to get a better job anywhere else Limited instruction is apt to be reflected in spoiled work and worn machinery Shops which train boys far beyond their daily needs will get more intelligent service, much better work and considerably longer equipment life.



For an apprentice course to be successful, everyone—manager, foreman and apprentice—must have confidence in each other and faith in the course

For an apprentice course to be successful, everyone—manager, foreman, and apprentice—must have confidence in each other and have faith in the course The question of which benefits most from an apprenticeship—employer or apprentice—depends on whether the labor received from the apprentice equals the training value he receives from his employer The rate of pay should depend on the same exchange of value

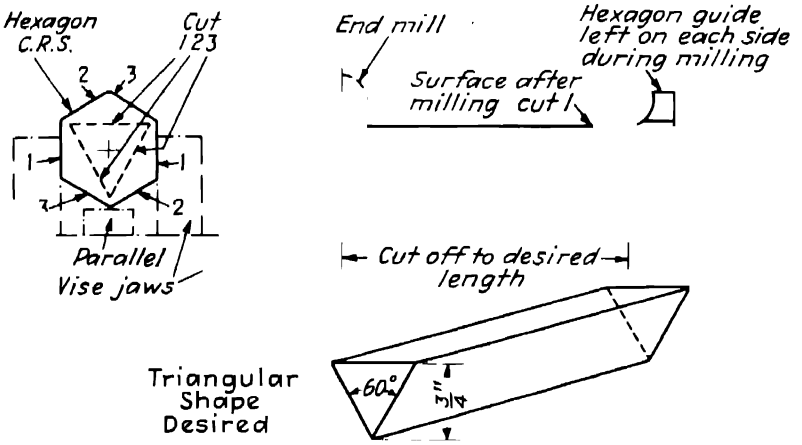
Shops which manufacture a single product, where necessarily the work is specialized, could trade boys with

other shops having a different class of work. As we expect the finished mechanic to think for himself and to have good judgment, he should be taught why as well as how all through his training.

In small shops that cannot afford a regular instructor, or where the number of boys will not justify the expense, the bulk of the training falls on the foreman. If he studies his boys attentively, and plans his own work carefully, he can get production from the boys almost immediately. The work can be arranged according to the skill required. The steps can be graduated to require very little training between successive steps. It is even possible to have the steps so close together that a few minutes of instruction every now and then will prove enough.

I have in mind a shop off the beaten path of floating mechanics. Older mechanics were suitable machinists, but they had no precision toolmaking experience. After trying to retrain machinists into toolmakers, it was found better to have an extensive apprentice course. The boys were trained in care and precision from the beginning. By insisting on high school graduates, the average caliber of the shop was raised. The work was done better and cheaper than before the apprentice system was started. Whenever a vacancy occurred a beginner was hired and several of the boys moved up a step. This caused a small amount of training for perhaps six boys, but not all the training for one boy. The almost constant promotion and raises kept the boys contented.

The course was so successful that employees in the methods department and assistant foremen have been recruited from the machine shop. A background of mechanics will help any foreman, even though he is not in the machine department.



How to get triangular stock in a hurry was solved by an apprentice with a flair for trigonometry

"Sines and Cosines"

BY GEORGE BUSMAC

BILL WAS AN apprentice machinist by day, and a student of "math." by night At the time I discovered this he had been dubbed "Sines and Cosines" by his fellow workers. Anxious to find the reason for the name I watched Bill and found that from the way he handled sines and cosines in his *trigger*nometry, he certainly was the best shot in the outfit.

I did my best to convince Bill that trig did not help much on the lathe, miller and shaper and much less when babbitting hanger bearings. But Bill was determined to carry on his study of sines and cosines.

One day the Chief wanted a triangular piece (as per sketch) for a new model, and as usual wanted it P.D.Q. I surveyed all my millers with indexing equipment, and all of them were in the middle of jobs which could not be stopped without spoiling the parts being worked. All that was left was an old hand miller with a vise with 4-in. jaws (no index equipment available). I called Bill, and giving him a piece of square C.R.S., told him to mill the other two sides to make the triangle. I allowed him one hour to produce the part and then left him to his own resources.

In slightly over half an hour, much to my astonishment, Bill laid the finished triangular piece, milled on all three sides, upon my desk; at the same time he gave me back the square piece of steel.

Trying hard to conceal my surprise I asked for an explanation. Bill answered, "Sines and cosines gave me an idea." He used a piece of hexagon stock, and holding it in the vise as shown, milled one side, then turning the hex. as numbered, he cut the second side and so on for the third side which completed the triangle. Then he cut off guide ends to make a piece of the required length.

Since then, I have encouraged apprentices, and hard boiled machinists as well, to study sines and cosines.

Race for Safety

SEABISCUIT races across the bulletin boards of the All-Steel Equip Company with every foot of the way hotly contested by an as yet unnamed dark horse. Each represents one of two teams of employees trying for the two monthly prizes given to the team with the best safety record. Employees are members of the "odds" or "evens" team depending on their clock numbers.

The "Safety Steeplechase" is a recent innovation to give added zest to a safety prize contest which this plant holds every month. It provides a graphic way of announcing team positions every day.

Scores depend on accidents which require doctor's care. For the first call 25 points are marked against the individual's team. Each additional call counts 2 points. At the end of the month the team with the lowest score is eligible for prizes. Lots are drawn to determine who on the winning team are to receive the two prizes. Those who have had points chalked against them for accidents are ineligible. If any one month's contest ends in a tie, the prizes are held over for the succeeding month's winners.

Value of the prizes varies from $10 to $15. Prizes never consist of cash. Instead they are always articles useful in the home or important to the employee. Thus the family as a unit has an interest in the contest and additional emphasis is given to the entire safety program.



Drop hammer die life is increased and forging quality improved by swabbing the die with oil containing colloidal graphite prior to each blow

Too hot for oil?

Just because moving parts are too hot to oil is no excuse for improper lubrication. A suspension of graphite often solves many problems at once

CONVEYORS for heat-treating ovens, lithographing ovens, enameling ovens, paint drying ovens, and other high-temperature applications demand a lubricant which will not flash off or carbonize at the temperatures encountered. One solution for this problem is the use of colloidal graphite suspended in a carrier best suited to the particular conditions involved. This carrier may be oil, naphtha, kerosene, carbon tetrachloride, or some other fluid.

Generally, the fluids or carriers are intended merely as a means to get the graphite to the desired bearing surfaces. Their selection will depend on the amount of penetration required, the speed with which they burn off, which affects penetration, and their flash point. Wherever high temperatures exist, experiment may be required to determine the amount of graphite to be included in the fluid carrier. In lithographing ovens, volatile organic fluids such as naphtha have been used as fluid mediums, because they flash off without leaving deposits. They are also used on assembly lines in auto plants and on paint conveyors in farm equipment plants because of their cleanliness.

While more graphite generally is used as the temperature and pressure increase, there are applications where the reverse is true. Some railways and railway equipment manufacturers have found that a small amount of graphite is most suitable for fire-box studs and superheater assembly.

In high-temperature fittings such as used in refineries and other processing plants where return bends and other joints have to be dismantled frequently, oil with colloidal graphite is used on bolt threads to avoid seizure and galling.

A chain-driven plate-type conveyor for carrying spark-plug insulators through a kiln was difficult to lubricate because the high temperatures caused ordinary lubricants to burn off, carbonize and flake. Two automatic lubricators of the air-operated spray type, were used to spray colloidal graphite suspended in carbon tetrachloride directly on the lower bearing surfaces. The carbon tetrachloride evaporates almost instantaneously because the conveyor has a temperature of 375 to 400 F. at this point, leaving a coating of dry graphite on the wearing surfaces. A small amount of kerosene and oil added to the solution slows up evaporation slightly and permits the graphite to completely cover and lubricate the bearing surfaces. It has been found unnecessary to use the lubricator all the time, as sufficient graphite adheres to give satisfactory 24-hour lubrication with only a short period of operation once a day.

There are special solutions of oil and colloidal graphite which are being used at temperatures as high as 1,600 to 2,000 F. Generally the main problem is to get a carrier which will get the graphite to the desired location before carbonizing.

Another point in the use of graphite as a lubricant in ovens is that acid fumes such as may exist in a bonderizing oven have no effect, while in lithographing ovens the varnish formed on the inside of the oven by the volatiles will not adhere to the graphited surface.

Several large forging shops are using lubricants as a vehicle for colloidal graphite. The lubricant acts only as a carrier because at the temperatures at which iron or steel is forged any lubricant burns off. It is in this very fact that differences in die lubricant vehicles occur. Whether a low or high viscosity vehicle should be used is a matter of some argument. It is contended that a higher viscosity material will make for slower burning with consequent less flash. Some automobile manufacturers now require exceptionally close tolerances in their forged parts. It is particularly important in this kind of work that the metal must not stick, which means that the oil vehicle must leave the die clean so that there is no build-up of materials to spoil the contour of the die. To avoid gummy deposits high-grade mineral oils, such as "bright" stock, are generally used as the vehicle.

With reference to the use of higher or lower viscosity materials it is possible in the simple and shallow dies to use lower cost, lower viscosity materials because the flash point is not as important as it might be in the deeper, more complicated dies. The graphitic content is about the same in both cases.

Indicating bore gages

BY C. C. STREET, CHIEF ENGINEER, FEDERAL PRODUCTS CORPORATION

Simple methods for testing the accuracy of indicating bore gages are given in this final installment of a series on common measuring devices

ONE OF THE most important divisions of the art of precision measurement is the gaging of cylindrical bores Here, limitations are set up because the fixture or device usually must be contained within the confines of the bore itself The limited space available often controls the possible design and principles applied Thus, it differs considerably from external gaging where, figuratively speaking, it is possible to control the alignment and relationship of the various locating devices without too much difficulty and, usually, as much room as needed can be taken up by the mechanism of the measuring instrument

Since in measuring cylindrical bores the space available is limited, the fundamental types of misalignment must be considered carefully The true diameter of the bore is the dimension usually desired Evaluation of this diameter is subject to basic types of errors First of these is the deviation of the measuring plane from the axis of the bore By examining Fig 13 it can be seen that

$$D_1 = 2\sqrt{r^2 - a}$$

where D_1 represents the measured diameter, r the actual radius of the bore and a the displacement of the planes This equation shows that for small values of a D_1 does not differ materially from true diameter D of the bore

Again referring to Fig 13 it is obvious that

$$D_1 = 2r \cos \alpha$$

and therefore the rate of change of D_1 is small for small values of α since the cosine remains equal to unity to three significant figures up to an angle of approximately $2\frac{1}{2}$ deg

The second source of error exists when the measurement is made in such a manner that the angular relationship between the diameter measured and the axis of the bore varies from a true perpendicular condition This can be seen by referring to Fig 14 Where D represents the true diameter, D_1 represents the diameter indicated by the gage, and b represents the displacement longitudinally in the bore of one of the measuring points, we have a relationship in which

$$D_1 = \sqrt{D^2 - b^2}$$

This might also be expressed by using β Here,

$$D = \frac{D_1}{\cos \beta}$$

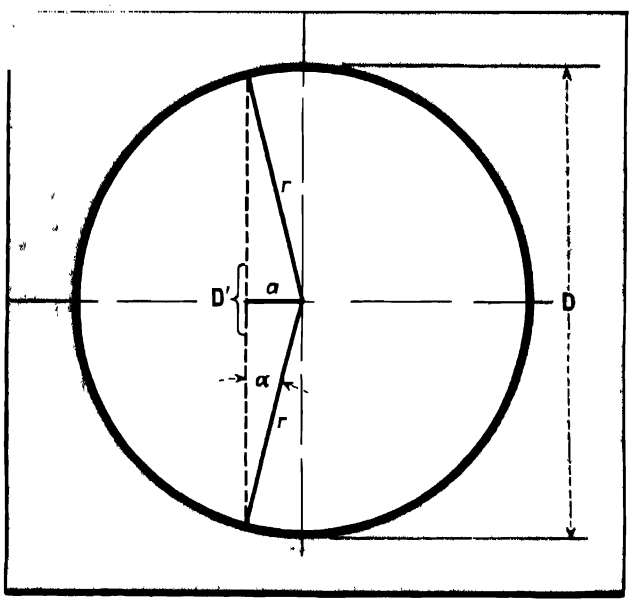


Fig. 13—Deviation of the measuring plane from the axis of the bore is one of the basic types of errors to be considered in bore measuring instruments

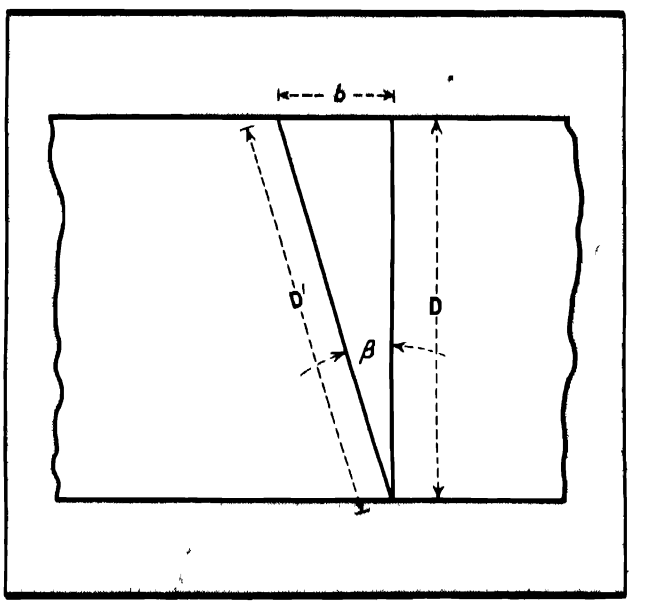


Fig 14—A second source of error in bore gaging is the possibility of taking the measurement when the diameter measured is not at right angles to the bore

referring to equation $D_1 = 2r \cos. a$, it can be seen that $2r$ might be replaced with D so that this equation would then be written:

$$D_1 = D \cos. a$$

Comparing this with the previous equation, it is apparent that for a lateral error of placement in the bore, the diameter read is directly proportional to this angular displacement, but in the longitudinal displacement it is inversely proportional, so where one error tends to decrease the indicated reading the other error tends to increase it, and both in a like manner.

This explanation shows the need for providing any suitable bore gage with means of automatically determining at least one of these positions. The usual method is to eliminate the lateral error and allow the operator to manipulate the gage back and forth and observe the minimum size indicated, which then will represent the true diameter.

Friction Always Present

To accomplish this purpose, a pair of contact points attached to a single body constrained to move parallel to the measuring point in a perpendicular manner represents one of the most satisfactory and conventional methods. Many methods have been used to obtain this constrained motion parallel to the contact point. Some of these have advantages over the others, but in nearly all there exists a certain amount of friction, so that the force exerted by the locating points usually is greater when they are being forced inward than when they are moving outward, even though in exactly the same position. This has a tendency to alter the load placed upon the fixed measuring contact and thus produces a slight error in the readings because of a variation in the contacts' penetration into the surface of the metal.

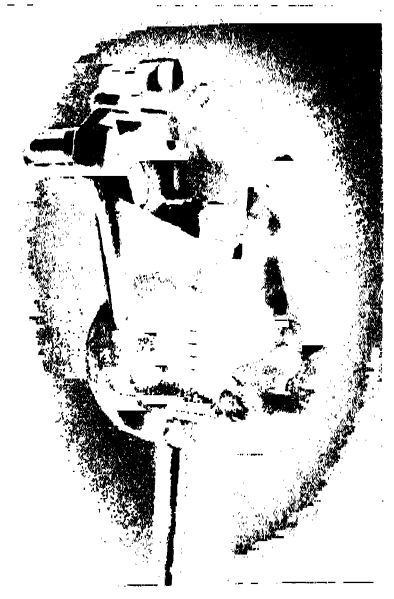


Fig. 15—In this design the body holding the centralizing points is pivoted on a spring hinge

In any sliding unit, such as a rod fitted in a hole, there must always be a slight amount of play which allows these parts to shift from the ideal alignment desired. This amount of play will, of course, increase with wear, particularly where it is liable to contamination from abrasive or dust in the air, as well as dirt from the part measured.

The method shown in Fig. 15 eliminates this difficulty, in that the body to which the centralizing points are attached is pivoted on a spring hinge. In this manner the friction usually encountered at this point is eliminated.

The various methods of transferring the motion of the contact point down the axis of the bore have, in many cases, been quite ingenious.

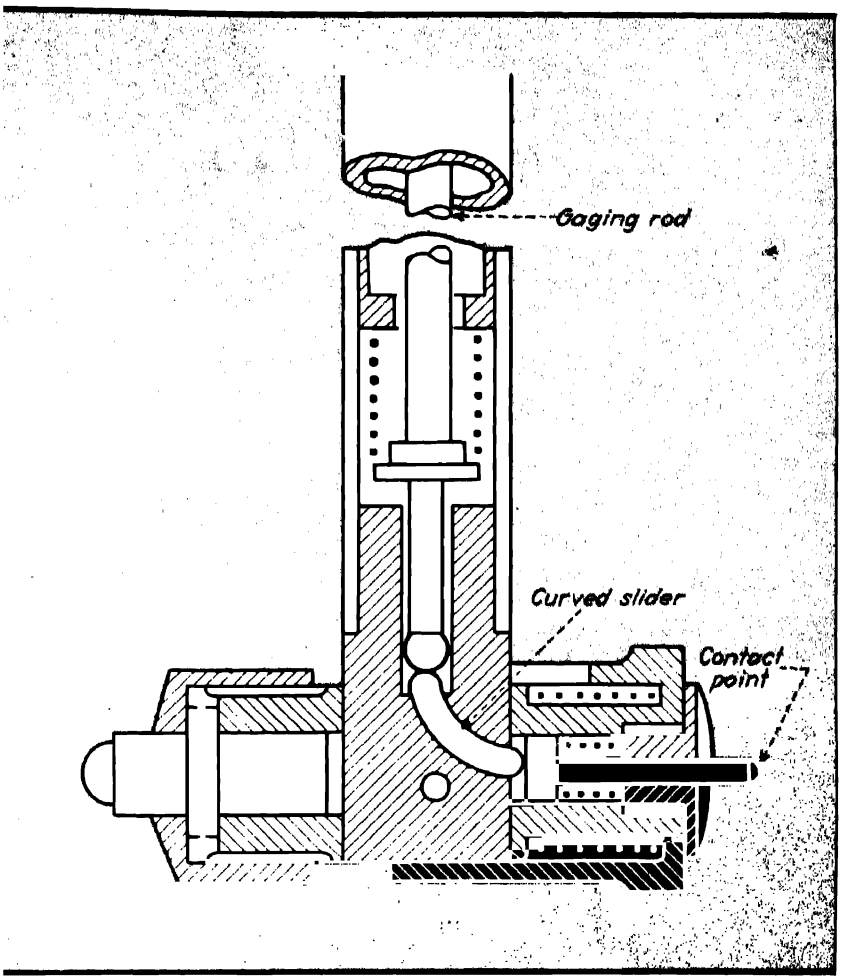


Fig. 16—A curved plunger in a curved slot transfers motion from the contact point down the axis of the bore in this type of gage head

Some have gone so far as to make a curved slot in which the quarter section of a ring is placed so that the contact point rests on one end and the gaging rod on the other. A motion causes it to slide around this curved slot, pushing the rod which is mounted in the frame of the gage. This method is shown schematically in Fig. 16.

Perhaps the bell crank has been used more generally than any other method. Its principle and construction is simple, and in most instances the friction produced by such a transfer mechanism is very low. The method shown in Fig. 15 almost completely eliminates friction at this point. Here the motion is produced by a flat spring placed at 45 deg., and therefore acting as a hinge so that the block to which it is attached must move outward the same amount as it is moved downward, and in that manner draws the attached rod with it. The indicator placed at the other end of the rod shows the movement of the contact point.

In considering the value of any

bore gage, there are a few simple tests that can be made to determine the fidelity to which the instrument will indicate the true size. It must be borne in mind when using such devices that they are, in essence, simply comparators, and at no time will give an actual measurement of the diameter. All that we can ask of such a gage is that it tell us faithfully the difference, if any, which exists between the bore being measured and the master ring used to set the gage.

This fidelity can be determined simply by placing the gage in the bore. The handle of the gage is raised so that the instrument reads plus, now when slowly lowering the handle it will be found that the gage gradually reads a smaller and smaller value until it finally reaches some minimum indication on the dial. This minimum indication should be noted. Now allow the gage handle to lower and then pull it upward slowly, gradually reducing the reading until again a minimum is obtained. Note, if any, the difference between the minimum values obtained by these two methods. If the difference exceeds more than one of the least divisions of the indicator dial, the value of the gage is questionable. Any gage that will give this minimum to less than $\frac{1}{2}$ a division is highly satisfactory.



Fig. 17—The gage can be checked by holding it at about 15 deg. off the axis of the bore and observing the minimum reading when slowly swinging the gage

The next operation is to successively approach the minimum value from the same side and note if there is any deviation between the values obtained. If the greatest difference is equal to not more than two-tenths of the least reading of the instrument dial, the gage can be considered satisfactory. A further test that might be made is to hold the handle of the gage at an angle of about 15 deg. with relation to the axis of the bore and see if the minimum value obtained by the method previously described differs from the value obtained when the handle is actually lined up with the bore's axis. This latter procedure is shown in Fig. 17.

It is well to bear in mind that all mechanical instruments, excepting those depending solely on spring mechanisms, contain an appreciable amount of friction. When dimensions are considered in such small units as 0.00005 in. these frictional forces can easily deflect, compress and alter the relationship of the various structural parts of a device to magnitudes even greater than this value.

With care, good results can be obtained with instruments that exhibit even a fair amount of friction, if they always are manipulated in exactly the same manner each time. If this is done these frictional forces tend to produce the same errors in the same directions. Skilled operators can show surprisingly satisfactory results by observing this rule of measurement, even with bore measuring instruments that are not of the highest quality.

Direct and Comparison Measurements

By ROBERT S. ALEXANDER

C. C. STREET's article on the subject of direct and comparison measurements (*AM*—Vol. 84, page 565) must have brought back memories to the oldtimers who worked without benefit of micrometer and vernier, yet managed to turn out creditable work. Yes, it takes the mechanic who has seen the day of the firm-joint caliper and scale measurement to really appreciate the progress that has been made in accurate measuring devices. The younger generation of machinists would probably quit if you took away his outside and inside micrometers, then asked him to bore a large diameter hole so that a shaft already turned would be a driving fit in the hole. If he didn't quit in disgust, he would lose several pounds worrying before the job was complete and accepted.

When browsing through my library not long ago, I came across a book, "The Turner's Handbook on Lathe Work and Screw Cutting," by W. E. Wharton, published in England many years ago. I bought this book in 1917 while serving my apprenticeship. A few of the oldtimers among my shopmates carried this book in their tool-chests, much as machinists carry the *American Machinists' Handbook* in this country. One of my shopmates claimed to have worked with the author in the Royal Arsenal, at Woolwich, sometime in the nineties.

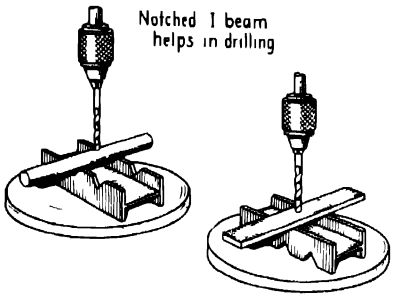
In this book the author describes a method of obtaining the above result that must be familiar to shopmen who were active at the turn of the century. The author points out that there is a standard which if worked to correctly will give no misfit or bad jobs when boring a hole to fit exactly a turned shaft, or to turn a shaft to fit a hole already bored. This standard for boring or turning is $\frac{3}{8}$-in. rock to the foot of a wire gage or calipers for a driving fit, and $\frac{1}{2}$ in. to the foot for a working fit.

As an example, the author takes a piston that is to be turned to fit a cylinder bored 24 in. in diameter. Make a wire gage to fit the cylinder so that it just touches as it is passed over the center. Then take dividers set to $\frac{1}{2}$ in. on the rule, and mark off from the center line thus obtained on both sides; this gives 1-in. rock set-out, which is the amount required for 24-in. diameter. Now ease the wire gage until it touches up to the line set out. It will take very little easing to accomplish this amount of rock, only a minute fraction of an inch being required. When turning the shaft or piston, set the calipers to the wire gage so that it can be felt to touch and finish the work at the same feel, having no spring on the calipers. This gives a perfect fit, without the need of taking the work out of the lathe to try it for size.

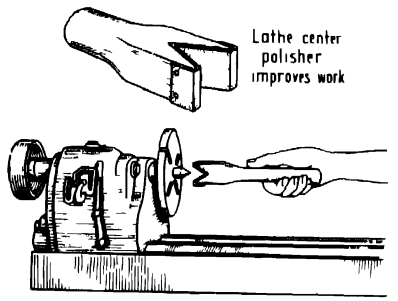
If the shaft already is turned and a hole is to be bored to fit the shaft, set the calipers to the job, then make a wire gage or set inside calipers to the outside calipers and bore the work. Take care to allow the amount of rock required; that is, $\frac{3}{8}$ in. for a driving fit, or $\frac{1}{2}$ in. for a working fit, for each foot of diameter.

SHORT CUTS FOR THE SMALL SHOP

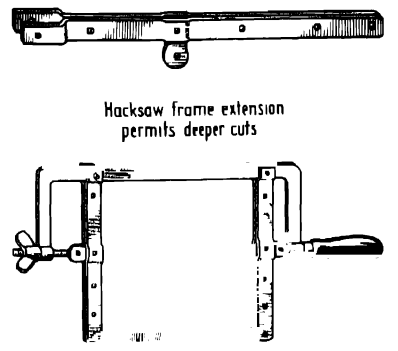
BY A H WAYCHOFF



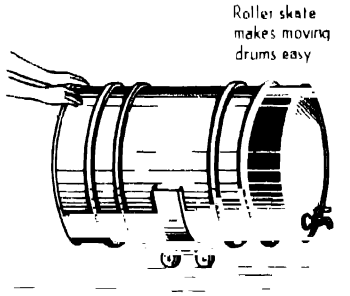
LESS BOTHER will be encountered when setting up work in small drill presses by using this short length of I-beam. It has a couple of pairs of V notches cut in the flanges on one side, with those on the other side left as is With it both round and flat work can be firmly supported, with plenty of clearance under the work for the drill to break through



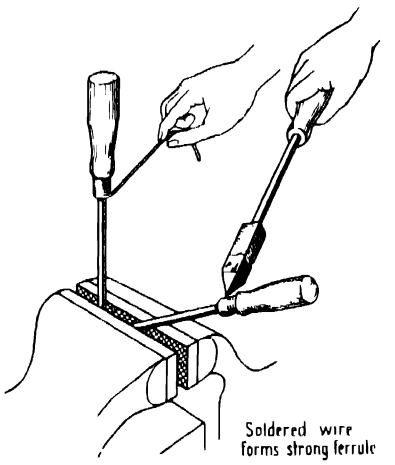
BETTER WORK on lathes is possible by keeping the centers nicely polished One of the easiest ways to do this is to use a hardwood stick with a 60 deg. V-notch in one end, with emery glued inside the notch This polisher used once in a while with the lathe running will keep the center point smooth and bright so it won't start cutting



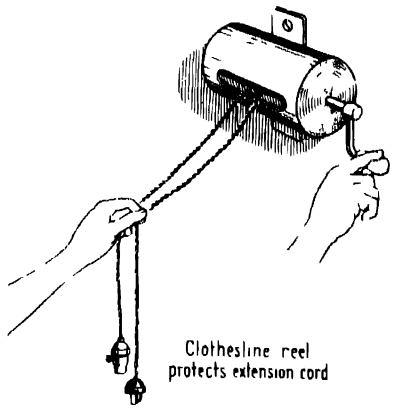
MOST HACKSAW FRAMES aren t deep enough to take care of some jobs, and few shops have a special deep frame Shown is an arrangement that takes less than a minute to slip on, and will do the work fine Each end link is made of two steel strips about three-quarters of an inch wide and an eighth of an inch thick The little strips that catch the blade holding pins in the frame can be made from an old butcher knife They're riveted between the strips forming the end links, which are riveted at a few other places also Then a couple of holes drilled in the hacksaw frame, four pins, and the device is ready for use By turning the wing nut the blade tension can be adjusted in the usual way, and the attachment can be removed o replaced in a jiffy



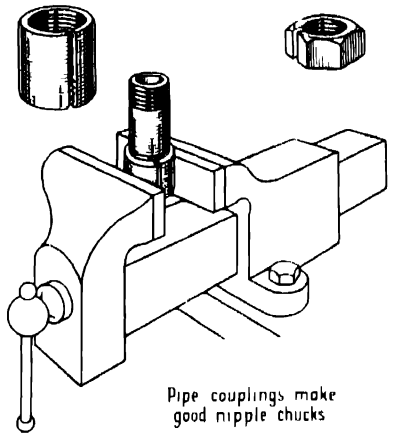
A HANDY TRUCK for all sorts of drums and barrels may be made by cutting a rather wide auto wheel or tire rim in two and then riveting it to an old roll r skate In use the barrel is simply rolled over the cradle with the cradle placed in the center Then a man can easily take hold of one end of the drum and roll it in any direction, getting in close places where it would otherwise be impossible



GOOD FERRULES for small hand tools can be made by winding the handle where the ferrule is to be with fine copper or brass wire Wind the wire smooth and tight, and with a hot iron flow solder all over it Then dress off the solder with a fine file till the wires just show This makes a very light ferrule, with many times the strength of a piece of sheet metal



EXTENSION CORDS usually are wadded up and thrown in some corner when they re not in use, making them tangled and knotted, and fraying the insulation till it s dangerous A way to protect the cord and find it easier is to wind it up on an ordinary little clothesline reel such as sold in ten-cent stores Remove the clothesline and drive a small pin about half an inch long through the spindle Then, with the reel mounted in some convenient spot, just double the cord, hook the loop over the pin, and start cranking Next time you want it you know that it's in the right place, and that it's not all tangled up or shorted



MECHANICS DOING PLUMBING or repair work will find this method of holding nipples much better than the common wrench or nipple chuck ideas With a hacksaw split one side of an old coupling of the right side, screw in the nipple and clamp the coupling in a vise Just a light pressure holds the nipple tight enough for threading and cutting, and there isn't a chance of damaging the threads Studs and bolts can be held the same way by cutting through one side of a suitable nut

IDEAS FROM PRACTICAL MEN

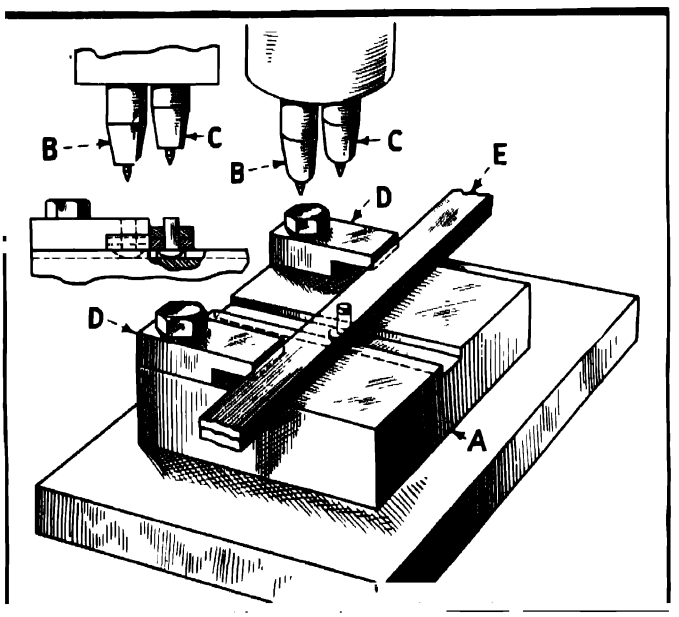
Double Die Speeds Riveting of Thin Sheets

By L. KASPER

We make a product of strip steel riveted together at specified points with hollow rivets, the work being done in a punch press. Two different thicknesses of material are used; at some points, two thicknesses of the heavier material are riveted together while at other points, the thinner material is riveted together. Ordinarily, the heavier pieces would be riveted together and the press then reset for the lighter pieces; however, cost of the article being produced did not permit of the additional handling. Therefore, the method shown in the drawing was adopted.

The die block *A* is fitted with two stops *D* for locating the material under the punches. Block *A* is grooved for receiving the rivet head, as shown. Two punches *B* and *C* are carried in the punch holder, punch *B* being longer than punch *C* by an amount equal to the difference between the two thicknesses of strip to be riveted. Punch *B* is located directly behind punch *C*, over the center of the groove.

In operation, the rivet is inserted in the holes in the two pieces *E* with the head of the rivet located in the groove in the die block *A*. The work *E* is then slid toward the rear until it contacts the stops *D*. If two heavy thicknesses are being riveted, they will contact the projecting portion of the stops *D*, which will locate the rivet in line with the shorter punch *C*. If, however, two of the lighter sections are being riveted, they will pass under the projecting sections of stops *D*, coming to rest under the longer punch *B*. In the drawing, two of the heavier pieces are shown in section, while two of the lighter pieces are shown dotted, indicating the positions they occupy when the punches descend.

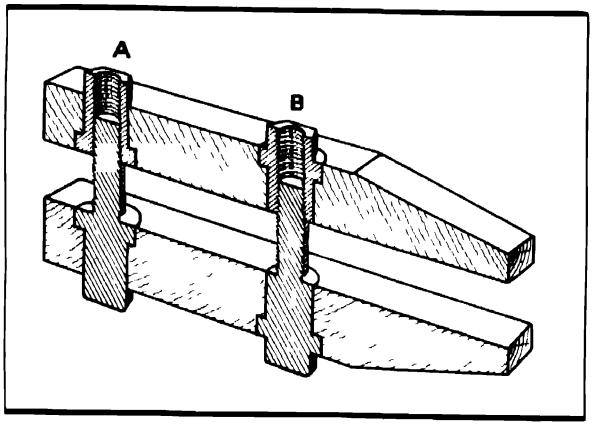


Punch press dies were arranged in this manner to rivet two thicknesses of heavy sheet or two thickness of light sheet, without changing the dies

Non-Interfering Screws for Parallel Clamps

By C. G. WILLIAMS

The conventional parallel clamp, with screws projecting in opposite direction from the jaws, often interferes with some part of the clamped work, especially when the latter is on a machine table. Here is a design which overcomes much of that difficulty.



The nuts and bolts of this parallel clamp do not extend far enough beyond the surface of the jaws to interfere with most types of clamped work

The screws of the illustrated clamp do not extend much beyond the jaws, and they can be tightened from either side. It will be seen from the drawing that both jaws of the clamp are exactly the same, that the nut *A* is countersunk from the inside, while the nut *B* is countersunk from the outside; both nuts are threaded for their entire length. The nuts and the heads of the bolts extend only far enough beyond the surface of the jaws to permit tightening with a wrench.

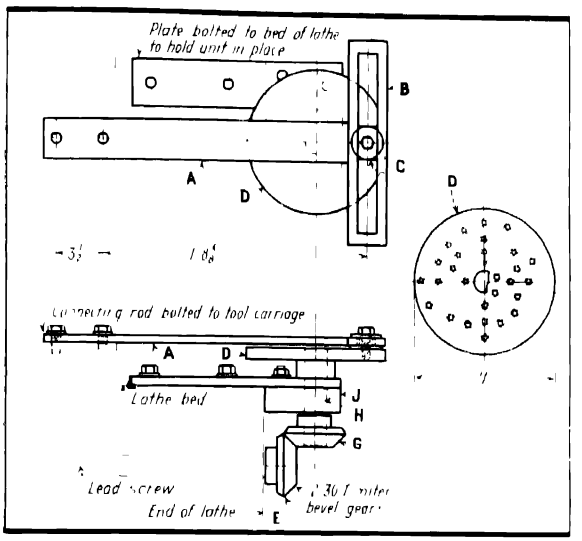
Lathe Attachment for Grooving Bushings

By ROBERT C. SMITHYMAN
Alliance Machine Company

The accompanying illustrations show a lathe attachment developed and built by the Alliance Machine Company for turning oil grooves in bronze

bearings. Hand or air chipping was a slow process and the grooves were not uniform. With the device here shown, bearings up to 6 in. diameter and 8 in. long were grooved in 90 sec., including time for setting up.

The problem was to find a method of feeding the tool. The ordinary feed on a lathe is not fast enough



A scotch-yoke attachment for grooving bushings, mounted on the end of the lathe bed and connected to the carriage, moves the tool forward the length of the bushing in one-quarter to one full turn of the faceplate

as the tool must travel the length of bushing in one-quarter to one full turn of the faceplate of the lathe This was solved by designing a feed attachment for the lathe.

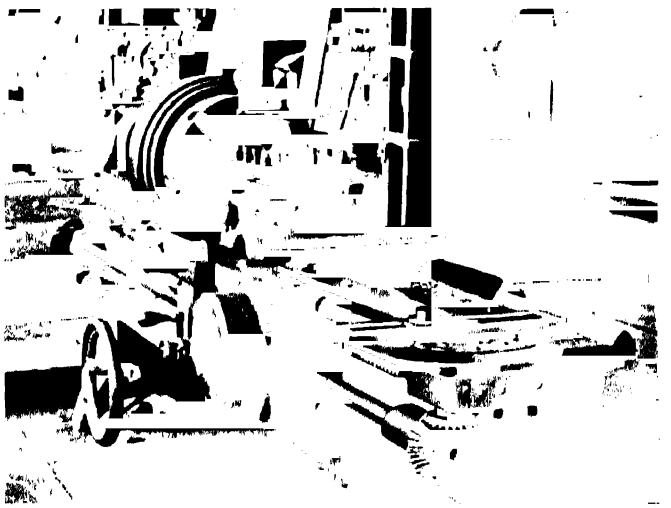
This attachment, designed to fit on the end of the lathe, consists of a connecting rod which is bolted to the tool carriage. The connecting rod, shown as *A* has a slotted bar *B* at the end opposite that which is bolted to the tool carriage. This slotted bar is fitted with a bronze slide block *C*, which is bolted to a turntable *D*. When the table revolves, this scotch yoke moves the carriage back and forth, thus oscillating the tool in and out of the bearing.

To rotate the turn table, a set of miter gears is used. One gear *E* is fastened to the end of the lead screw. The other gear *G* is fastened to a shaft *H* welded to the turntable. Therefore, a definite tie-up is made between the speed of the lathe spindle and the speed of the tool feed. The ratio between the two can be changed in the usual way of changing the gear ratio at the end of the lathe.

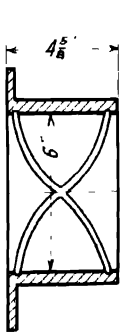
The complete unit is fastened to the end of the lathe by a steel block *J*, which is bolted to the bed of the lathe between the ways in such a manner that the tool carriage can pass over it. The steel block has a hole through which the shaft passes. Holes are drilled in the turntable to obtain a different length of stroke for different length bushings.

The use of the slotted bar and slide block on the connecting rod makes possible the desired harmonic motion so that the oil grooves will intersect in the center of the bushings when the rotational speeds of the faceplate and slide and the length of the connecting rod *A* are such that the tool goes in on one turn of the plate and out on one turn.

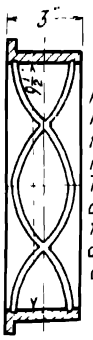
The tool is placed in a bar and is ground in such a way that it will cut when the tool is fed either way



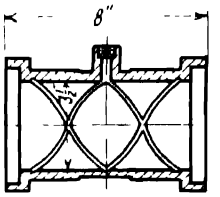
The harmonic feed of the grooving tool depends upon the relative speeds of the spindle and carriage. The ratio between speed and feed can be adjusted by indexing the turntable, thereby changing the length of the connecting rod



Ratio between bearing and feed is 1 to 1. As the bearing revolves once the tool is fed in and out The tool is then started at a starting point 180° from first starting point



Ratio for this groove is 1 to 2. The bearing revolves once. The tool is fed in and out twice The tool is then started at a point 180° from first starting point and another groove cut



Ratio for this groove is 2 to 1
The tool is fed in on one full turn of the bearing and out on one full turn of bearing

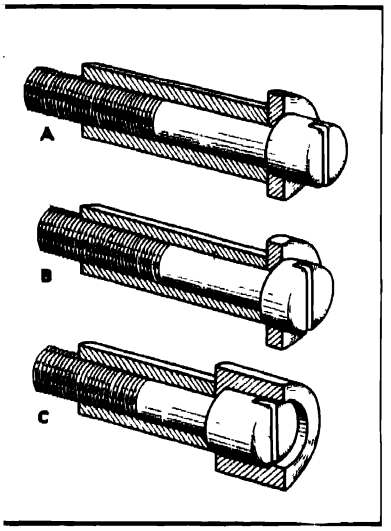
These three types of grooves can be cut in bearings in 90 sec. or less, including time for setting up the job

through the bearing, forming an endless groove. The tool is then started in again 180 deg. from the point where the first groove was started and another endless groove machined.

Stripper Screws of Variable Length

By H. R. HAGEMAN

Quantity produced shoulder screws designed for limiting the travel of stripper plates on punch and die work have become quite popular because of their convenience. But they have a few objectionable features which are overcome in the type of screw shown in the drawing. It will be noted that in each of the three different screws shown the shoulder is formed by slipping an ordinary fillister head capscrew through a



These fillister head capscrews, slipped through a piece of tubing, overcome some of the objections of shoulder screws used for limiting the travel of stripper plates on punches and dies

piece of tubing of the required length with a special washer under the head.

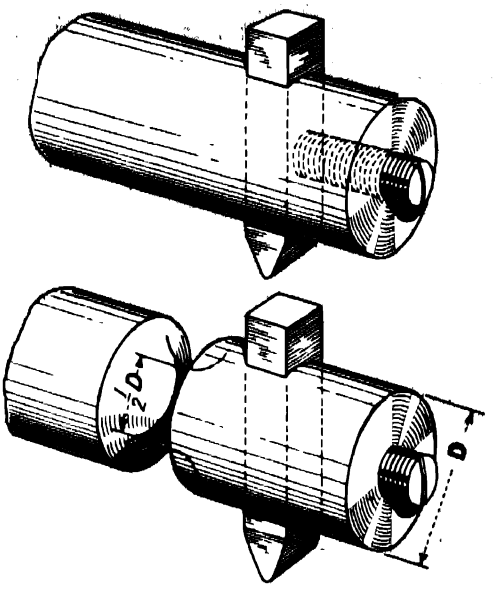
This is a decided advantage over the solid shoulder screws, and makes it unnecessary to stock so many special screws. They are not so liable to break because of no sharp corner at the shoulder, and should they break they can be replaced at little cost. They can be shortened readily to compensate for wear of the punch steel, thus maintaining the proper amount of travel on the springs.

In the absence of tubing of the required dimensions, iron pipe can easily be adapted, $\frac{1}{8}$-in. pipe for $\frac{1}{4}$-in. and $\frac{5}{16}$-in. screws, $\frac{1}{4}$-in. pipe for $\frac{3}{8}$-in. screws, and so on.

A Niched Boring Bar Reduces Chatter

By ARTHUR L GREENE

Niching of a boring bar to half its diameter just above the cutting section will reduce vibration and chatter and increase production approximately 25 per cent. This is the finding of Henry O. Luther, specialist in precision machine work at the Package Machinery Company. Work with the new bar shows that the cutting tools have much greater life between



The theory behind this niched boring bar is that the spring in the bar provides a wrist action which takes up shock and vibration

grinds, and that they may be run at about 25 per cent higher speed without vibration and chattering.

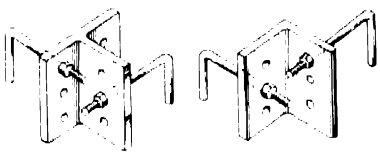
All bars used on the company's jig boring machines are now being turned down to take advantage of this fact. The bar can be niched, or it can be gradually necked down until the narrowest point is reached about $1\frac{1}{2}$ in. above the bar head.

The theory is that the niching of the bar gives a certain spring and provides a wrist action which has a tendency to take up shocks and vibration coming to the bar from the boring tool. In this way the amount of vibration transmitted to the bar itself is cut down.

Simple Clamps for Assembling Welded Structures

By F. SIDNEY

A few well-positioned clamps greatly assist erecting and assembly operations, especially on light welded



Steel sections fitted with hook bolts make convenient clamps for assembly operations, especially on light welded structures

structures. Two of the many types of clamps are shown in the illustration. Both are of simple design and made from steel sections.

The one made from angle section is useful for corner and cross-wise holding of parts. The clamp made from the T-section is handy for junctions, where the work lays in vertical and horizontal planes.

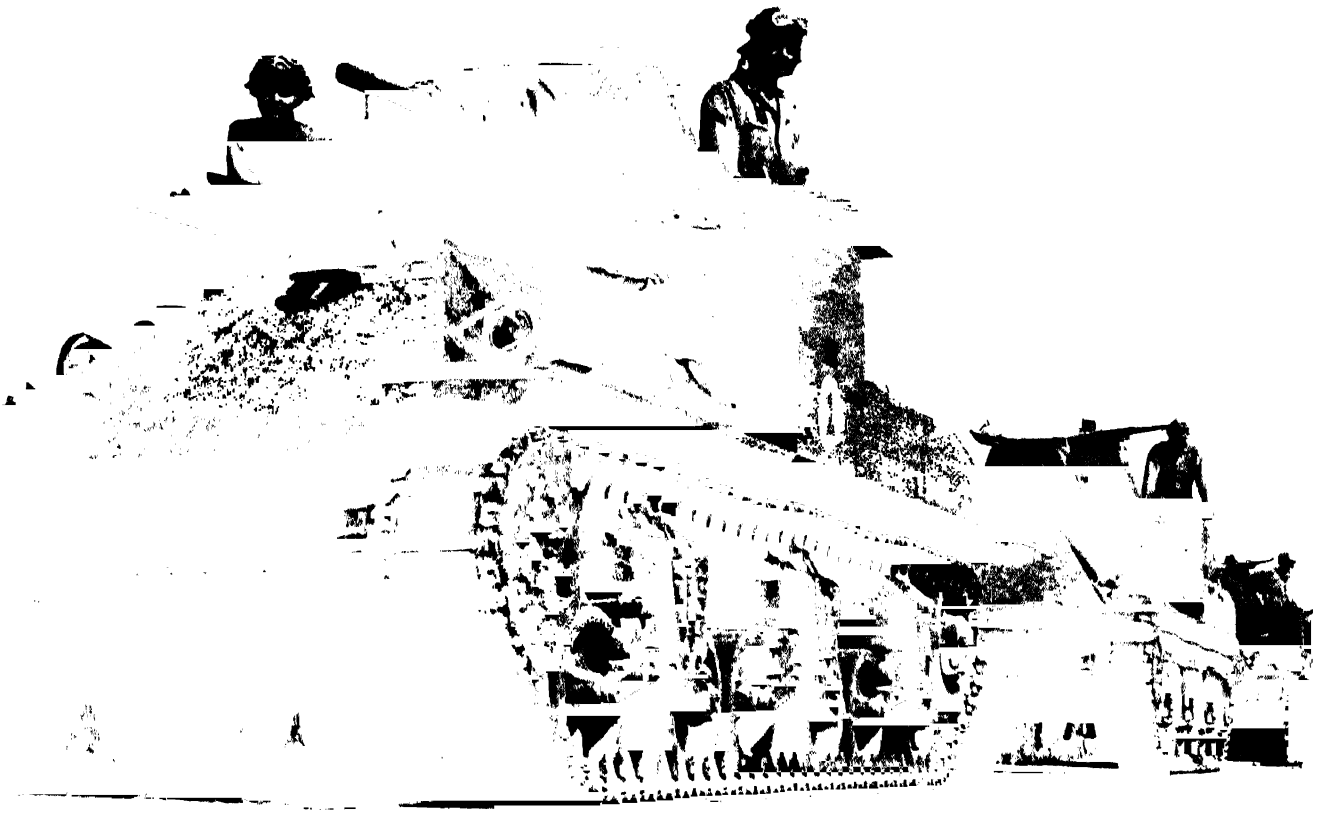
DYNAMICS OF DEFENSE

BY MAJOR ROBERT GINSBURGH

HOW TO MAKE ARTILLERY CARTRIDGE CASES

BY FRANK J. LERRO

DYNAMICS OF DEFENSE



The medium tank is a land battleship, weighs more than 20 tons and has armor heavy enough to resist 37-mm guns

France dug in and then caved in, a tragedy of static defense. Mechanized armament has moved a long way since the World War. Here are some of the trends

BY MAJOR ROBERT GINSBURGH, U. S. ARMY

Assistant Executive, Office of the Assistant Secretary of War

More power! More speed! More protection!

Every general staff is calling upon its technical experts for armament that will combine all three factors. Yet the mere recital of these requirements indicates that they are not reconcilable with each other. The more the power, the greater the weight, and therefore, the lower the speed. The more the speed, the lighter the bulk, and therefore, the less the power. The greater the protection, the heavier the weight, the less the speed, and the less the power.

Strange as it may seem, however, there is a decided trend in the armament of all great powers to realize this combination with unprecedented efficiency. The reason? The modern internal combustion engine.

Consider, for example, the tank or the combat car. No longer is it the cumbersome vehicle of yesterday, moving at four or five miles an hour protecting slow moving infantrymen while affording cover to its own operating crew. Its basic requirement of force has not been abandoned. On the contrary, it has been increased. The most modern types carry not only heavy machine guns but light artillery. They move at 40-mile-an-hour speeds, and

they carry protective armor that tends to resist even 37-mm. anti-tank guns; they are not always stopped by 75-mm. ammunition. From Finland and from France have come reports of 70-ton tanks used by the Russians and the Germans respectively.

So far, the United States Army has announced that it is producing light and medium tanks. Our light tank carries a crew of four men and has armament which equals the fire power of at least 50 men with rifles. It weighs about ten tons and can run at high speeds both on roads and over rough terrain. It can knock down trees six inches in diameter and has armor thick enough to keep out ordinary .30 caliber bullets. With its great speed and cross country mobility it is as hard to hit as a rabbit.

The medium tank is much larger and heavier than the light tank, carries more powerful guns, and has a crew of six men. It is, in fact, a land battleship capable of crossing wide trenches, knocking out machine gun nests and overcoming strong enemy resistance. Its armor is heavy enough to keep out much heavier projectiles than that of the light tank. It weighs more than 20 tons and has a road speed of around 30 miles per hour. It has a powerful engine, protected by armor and carries a liberal supply of gasoline likewise protected. The armor is relatively thick, and can repel most small arm projectiles.

The Iron Horse Joins the Army

The American combat car, the "heart" of the mechanized cavalry, is a light tank, protected by armor and equipped with the weapons needed to accomplish the tasks appropriate to that arm. The vehicle weighs about eight tons and has a maximum speed of about 50 miles per hour.

Whenever an innovation in armament is introduced by one country, the others logically follow. Heavy tanks have been noted in Europe; and America is studying, experimenting and testing their possible value in our own mechanized program.

The interplay of the triumvirate, power, speed and protection, appear in aviation in a manner even more spectacular than they do in the tank or combat car. General staffs are demanding increased armament both in the number and in the caliber of the guns mounted on the plane. They call for terrific speeds not only in pursuit ships but even in heavy bombers. They ask for heavy armor plate so placed as to protect the pilot from hostile fire.



In the early stages of the present war, there was a tendency to think principally in terms of speed and power, but as casualties among pilots multiplied, the protective factor assumed greater importance. A trend toward heavier protective armor has been found among the warring nations.

The trend toward leak-proof gasoline tanks is indicative of a similar desire for greater protection. These have greatly reduced the effectiveness of .30 caliber bullets and have tended, therefore, to make the plane far less vulnerable than in the past.

To counteract this development, heavier machine guns and even cannon are being mounted in cockpits overseas. These, in turn, increase the weight of the planes and should tend to reduce speed, yet there is no indication that the fighters or the bombers are moving any slower. The increase in weight caused by the added armor is met, in some cases, by a reduction in the number of the crew. The need for armor has also been reduced by development of more effective fire power at greater distances.

A trend by definition precludes stabilization; and in aviation, especially, it is difficult to conclude which of the three factors, of power, speed, and protection, at any given moment has the upper hand. Fluctuations are continuous.

The P-38, which the Army Air Corps regards as the best interceptor pursuit airplane in the world today, is an illustration of the trend in America. Heavily armed, it is capable of more than 400 miles per hour. It has a range of 600 miles or more. It has leak-proof tanks, and provides armor protection for the pilot to include .50 caliber bullets.

Modern Doughboy Uses Many Weapons

Let us now turn to less spectacular armament, though in the final analysis, as important as planes or tanks. An army essentially is a team effort, and a weakness in any type of machine or weapon is likely to develop a point of vulnerability of which an intelligent enemy will take advantage. It is wise always to assume that the enemy will be intelligent and to prepare accordingly.

In the infantry, the trend toward power has multiplied the number and types of weapons needed for the doughboy. There was a time, and not so long ago, when infantryman and rifleman were synonymous. Today he pushes the assault with pistol, grenade, rifle, bayonet, machine gun and mortar, supplemented by tanks, field artillery, and airplanes.

For speed, he depends on fast moving trucks that carry him close to the battle lines or move him quickly to other sectors when the situation demands. This trend does not mean that the three mile an hour feet of the doughboy no longer serve in battle. On the contrary, reports from overseas indicate that there is still plenty of marching and countermarching. Examples of infantry moving on foot day after day, ten, twenty and even thirty miles are common despite the introduction of mechanized means of transport.

For protection, he depends on his own anti-tank and anti-aircraft guns and on his supporting planes and artillery.

In small arms used by the infantry, the trend is away from the manually operated rifle to the semi-automatic, a combination of speed and accuracy. The American Garand probably represents the best in the semi-automatic field. It will supersede the old reliable Springfield which has been

recognized for many years as the most efficient bolt action military rifle in the world. With the new gun, no manual operation is necessary between shots. The rifleman maintains his aim on the target and fires by squeezing the trigger for each individual shot. It uses the same ammunition as the Springfield and is equally accurate. A trained rifleman can fire 60 aimed shots per minute as compared with the rate of fire of only 15 shots per minute with the old standard rifle. It weighs approximately nine pounds, and its most efficient rate of fire is about two and one half times that of the Springfield. It can be fired with considerably less fatigue on the soldier, due to its reduced "kick".

The Garand uses ammunition more rapidly and, therefore, adds to the difficulties of supply. Its production in mass is taking considerable time, but once it becomes available to every rifleman, it is expected to meet the most exacting demands of the modern doughboy.

In machine guns the trend is toward greater numbers of light automatic weapons with higher rates of fire. In Europe, water-cooled machine guns are giving way to air-cooled types. In our own Army the basic machine gun is the caliber .30 Browning. It has a maximum rate of fire of approximately 500 rounds per minute with a range of about three miles which is approximately 50 per cent greater than the World War type.

Since the World War, the Army has added the heavier .50 machine gun. The mechanism of this gun is almost identical with that of the lighter Browning. It is of the recoil type, belt fed, and water cooled. It has a maximum rate of fire of about 400 rounds per minute with maximum range of approximately four miles.

Unpopular World War Mortar Superseded

The trend toward greater infantry fire power is reflected in the increase and development of mobile mortars. The small World War Stokes, with its tumbling trajectory, limited range, and characteristic tell-tale sound, was despised by front line troops because it invariably disclosed their positions. In its place, the American infantrymen will use 60 and 81-mm. mortars.

The 60-mm. mortar is a direct fire weapon and has a maximum range of 1900 yards. The minimum safe range is 75 yards which is just beyond that of hand grenades. The projectile weighs slightly more than three pounds. The total weight of the mortar and all accessories is approximately 50 pounds, and it is easily carried by two men.

The 81-mm. mortar fires projectiles weighing about seven pounds to a range of some 3200 yards, but the propelling charges are arrayed in increments so the shell can be fired at elevations varying from 45 to nearly 80 degrees, thus permitting plunging fire at short ranges. This weapon can be transported on pack mules, on hand carts, on animal-drawn carts or in trucks.

To protect the doughboy against modern enemies, he is now furnished anti-tank and anti-aircraft guns.

In the anti-tank field, the trend is toward greater power. Since the tendency in tanks is thicker and thicker armor, a parallel development of projectiles that can penetrate deeper and deeper must keep pace. At the outbreak of the present war, the European nations put their faith in anti-tank guns in the 37-mm. class. Today the trend is toward a much heavier weapon, perhaps not as great as the French 75 which unexpectedly had to wheel into action, but certainly to something greater than the 37.

For the present, the American Army is equipping its infantry with a 37 that can defeat the average modern armored target. It throws a projectile weighing almost two pounds at a speed of half a mile per second. It covers a front of 45 degrees and can be operated by one man. It can be towed at any speed behind a truck, and is light enough to be manhandled by the regular crew. It has a simple telescopic sight so arranged that one man can control and fire the gun with a minimum of effort. It has proved itself by test to have extraordinary accuracy on stationary and moving targets.

For Bringing Down "Hedge Hoppers"

The high speed low flying attack plane has caused a trend toward equipping infantry with an anti-aircraft gun, more powerful than a machine gun, but not large enough to be included in the category of light artillery. The recently developed American 37-mm. anti-aircraft gun is illustrative of the tendency. It is mounted on a mobile carriage which may be towed by a truck at high speed. It is capable of getting into and out of action almost instantaneously, is mounted for all around fire on a four wheel trailer, and operates under the same principles as a machine gun, though not quite as fast.

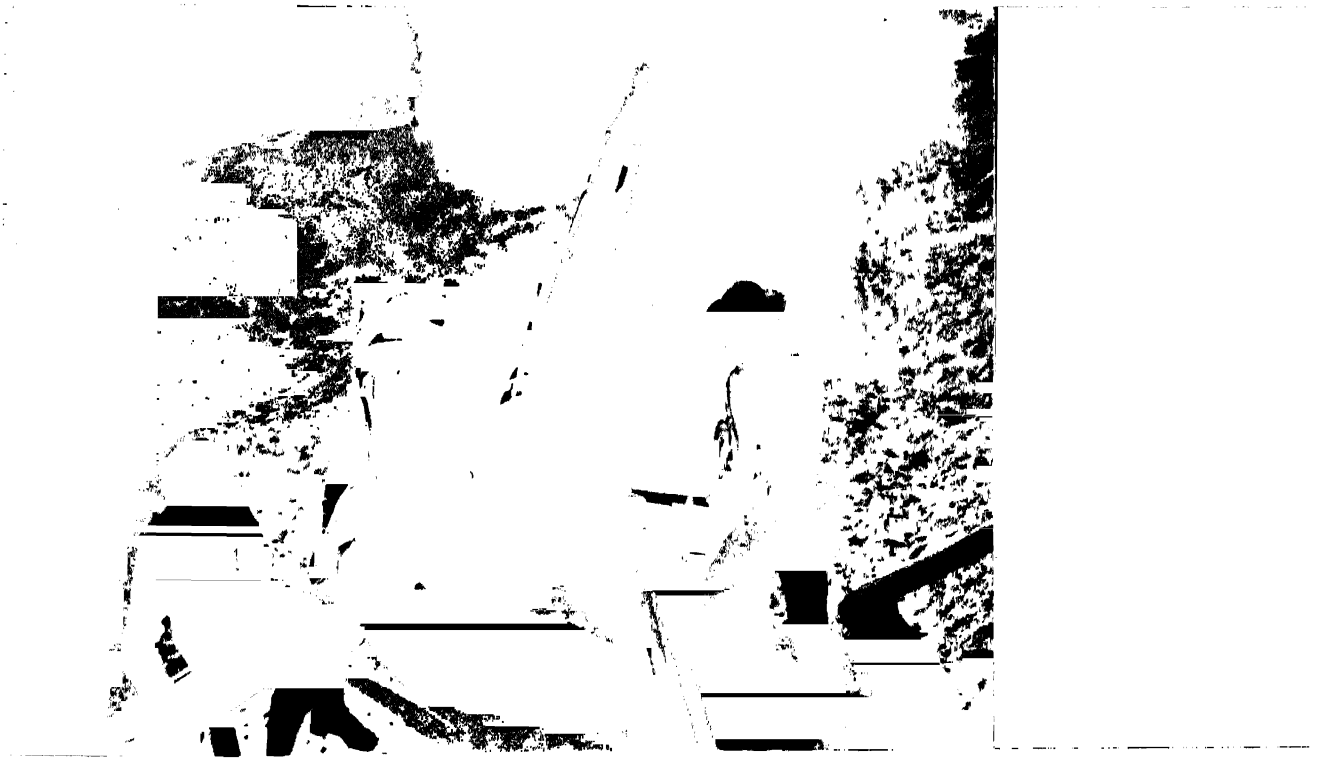
Light artillery, like planes and tanks, show a tendency toward greater mobility and greater power. In the trend toward greater mobility may be noted the new split-trail carriage for the French 75 which can be towed at great speed by fast moving trucks. When ready for action it can raise its elevation to fire up to eight miles instead of five as it did during the World War; and without shifting position it can sweep over an area of 1200 mils in contrast to the 1917-18 zone of about 100 mils.

While the trend toward motorized artillery has been pronounced, it is worth noting that in the German army horse-drawn artillery is still the rule rather than the exception. Practically all of its infantry divisions, which represent 80 to 90 per cent of the total ground forces, have field artillery drawn by horses.

Not content simply with modernizing its 75 carriage, the American army is following the trend

toward a heavier divisional field piece. It has adopted a 105-mm. howitzer for distribution to the field artillery as soon as produced in sufficient quantities. This shift to a heavier weapon was most pronounced in Germany where the 77-mm. gun, of World War model, gave way entirely to the 105-mm. howitzer. Germany, limited to 300 pieces of field artillery of all types by the Versailles Treaty, had no investment in old guns to protect when it decided to arm. All other countries had World War types in large numbers which they felt they could not scrap. Their heavier field pieces were in the blueprint stage when Germany struck with the real howitzers.

The increase of calibers of divisional field pieces has been paralleled by similar increases in calibers of anti-aircraft artillery. As planes fly higher and faster, the demand arises for greater range and higher muzzle velocity. As they add armor, the call comes for more powerful projectiles with greater fragmentation radii.



Heavier Anti-Aircraft Gun Adopted

In the 3-in. anti-aircraft gun, the American Army has an excellent mobile weapon for use against enemy planes flying at considerable altitude. It fires a 12.7-lb. high explosive shell to a height of approximately six miles. From 25 to 300 accurately aimed shots can be fired from this gun per minute. It is mounted on a carriage with pneumatic tires and anti-friction bearings which permits towing behind trucks at high speeds. In firing, the weight is removed from the wheels by means of lifting jacks. A well-trained gun crew can go into action from the traveling position in approximately fifteen minutes.

In the light of experiences abroad, which indicate the need for even more powerful anti-aircraft weapons, the Army now has begun production of a 90-mm. gun that can fire higher, faster and inflict damage over a wider radius.

In the heavy field artillery, changes have been few. There is a trend toward mounting heavy guns on mobile carriages and away from fixed fortifications. For the protection of port entrances, the permanently emplaced gun is still of major importance.

Developments in heavy artillery carriages have contributed to increases both in range and speed. An example of such improvement is found in the combined 155-mm. gun-8-in. howitzer carriage upon which either of the two field pieces can be mounted. This carriage is equipped with pneumatic tires and air brakes which permit the gun to be towed behind high speed trucks. In firing position, the carriage does not rest on the wheels but is lowered to the ground by self-contained jacks. The range of this weapon is approximately fifteen miles, which is 50 per cent greater than that of the World War type.

The trends in individual weapons are reflected in their employment. It must be remembered that it is in their combined use in an intelligent manner that the technique and the resultant tactics and strategy of the Army as a whole come into play. Power, speed and protection in each weapon and in their combined employment—there is the modern formula in armament. America has noted the trend and is preparing accordingly.

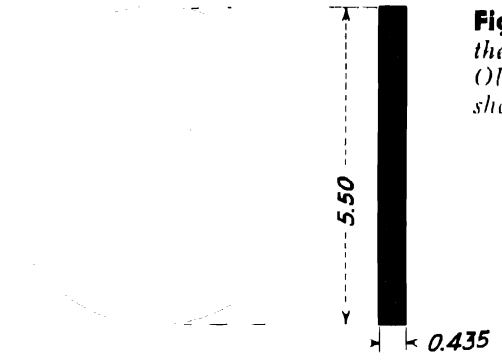


Fig. 1—*A disk of the dimensions shown provides the raw material for the 75-mm. cartridge case. Obtaining the metal in this form, rather than sheet, saves handling of scrap*

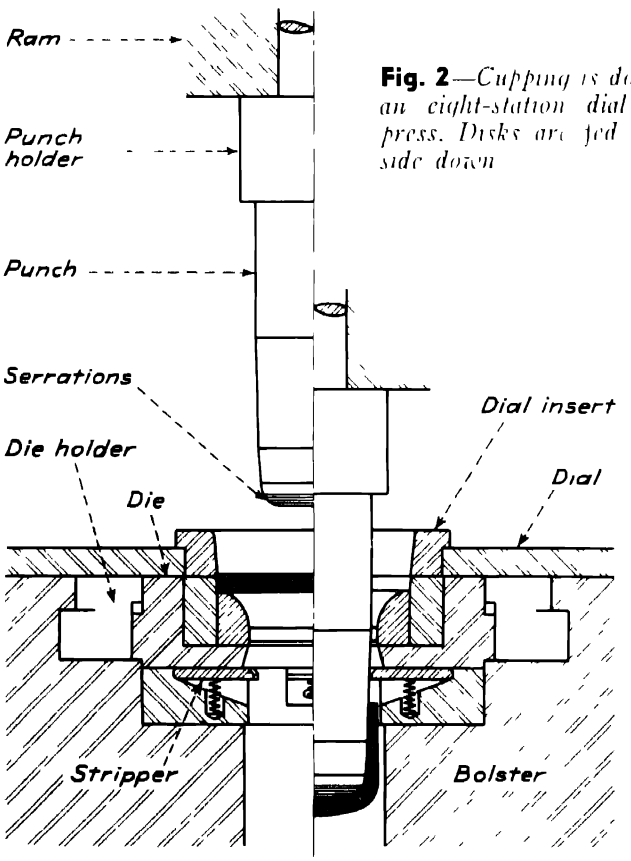
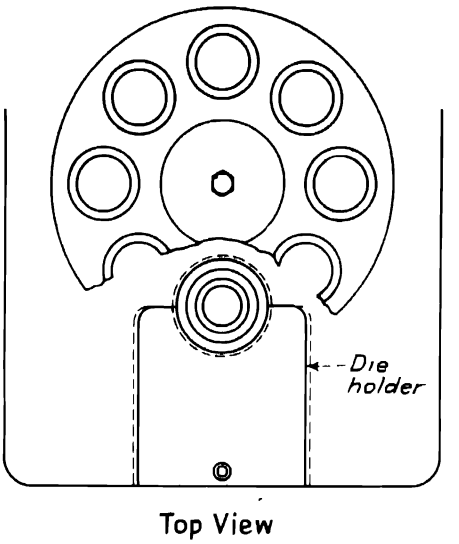


Fig. 2—*Cupping is done in an eight-station dial feed press. Disks are fed sharp side down*



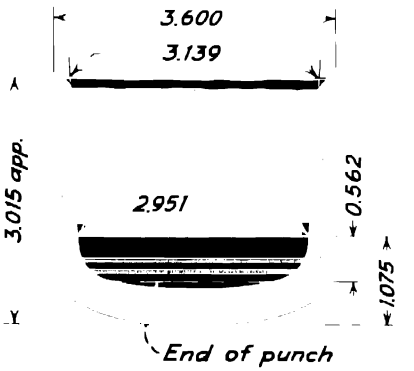
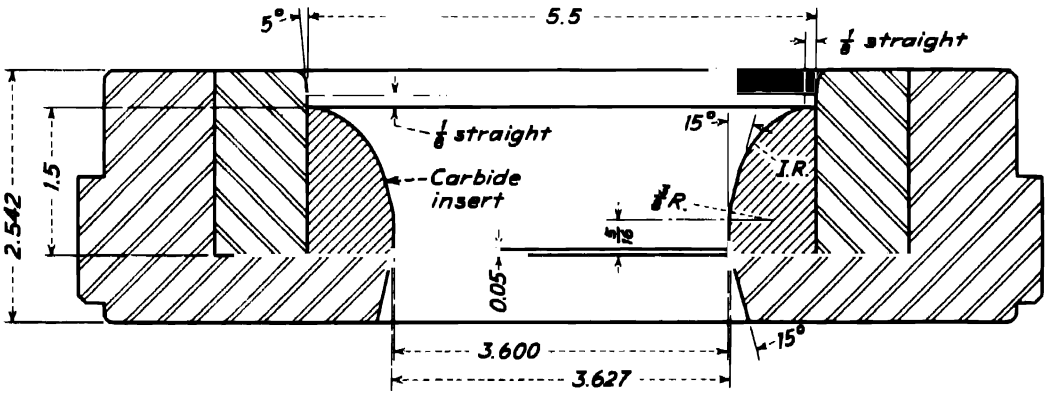


Fig. 3—*Cups are drawn to these dimensions. They must be free from grooves that will carry through to subsequent redraws*

Fig. 4—*A sectional view of the cupping die shows the carbide inserts on the sections receiving the greatest abrasion*



HOW TO MAKE ARTILLERY CARTRIDGE CASES

A companion article to "How to Machine 75-mm. Shell" (AM—Vol. 84, page 667) tells of the latest tooling for press work and machining operations on the cartridge case

BY FRANK J. LERRO

Foreman, Artillery Cartridge Case Shop, Frankford Arsenal

WITHIN the past few years many improvements have been made in the manufacture of artillery cartridge cases at Frankford Arsenal. The 75-mm. cartridge case is offered as a typical example of the tool development being carried out to reduce the number of operations necessary in the manufacture of cartridge cases without sacrificing quality.

During the last war and until recently, this particular cartridge case was made in five redraws with an indenting operation in between to obtain necessary metal for the heading operation. It now is made in three redraws with no indenting operation required between them.

The following is the method used at Frankford Arsenal to manufacture the 75-mm. cartridge case.

The first operation is the cupping of a commercially procured disk of dimensions shown in Fig. 1. This disk is made of cartridge brass (70 per cent copper—30 per cent zinc), having a Brinell hardness (500-kg. load, 10-mm. ball) of 43 to 65 and a tensile strength of 40,000 lb. per sq. in., with a grain size of 0.055-0.115 mm. magnification × 75.

This operation is done on a mechanical press equipped with an eight-station dial feed. It is cupped as shown in Fig. 2. The final dimensions of the cup are shown in Fig. 3.

The disks are fed into the die nest, sharp side down, to obtain the best drawing edge for subsequent redraws. If this drawing edge has the slightest gutter around the middle of the side wall at the top of the cup, it will form a gutter or groove on the inside surface of the side wall in the following redraws and, in all probability, cause a tearing of the metal at this point. This is caused by the metal of the side walls tending to fold around the punch while drawing through the die.

Because of the importance of proper design of the cupping die, a detailed view, Fig. 4, is shown along with the set-up sketch. The design of this cupping die, along with the serrations on the nose of the punch, has proved satisfactory in holding enough metal at the base to permit heading the cases without relying on an indenting operation to accumulate enough metal to do so.

One hundred and twenty-five tons are required to perform this operation. The drawing speed used is approximately 75

ft. per min. The reductions in wall thickness vary from 30 per cent at the bottom wall to 50 per cent at the top wall of the cup, along with a reduction of 35 per cent of the disk diameter.

Following this operation and after the first and second redraws, the cases are annealed in batch-type furnaces to a temperature of 1,125 F. and are left in the



Fig. 5—*The elonged grain structure (left) is broken up by annealing to put the work-hardened metal in condition for the following operations*

furnaces to obtain the following grain sizes at mag. × 75:

After the cupping and first redraw 0.060-0.080 mm.

After the second redraw. 0.035-0.045 mm.

Fig. 5 shows the grain structure of the metal after the cupping operation and after it has been annealed to a grain size of 0.065-0.075 mm., mag. × 75.

It might be well to mention here that it is useless to give the limits required to obtain these grain sizes as they depend on the type and efficiency of the furnaces used to anneal cases. At Frankford Arsenal, the furnaces average approximately 2,000 lb. per hr. and are of the forced convection type.

After the cases are annealed, the basket, containing annealed work, is lowered into a large tank and sprayed with cold water. This same basket (15 per cent chromium —35 per cent nickel) is carried into another tank containing a 12 per cent (by weight) sulphuric acid solution. The cases remain in this solution for approximately 2½ min. after which they are lowered into Tank 2 for a plain cold-water rinse; next they are placed in Tank 3 containing a soap solution (0.2 per cent by weight of soap chips, 0.2 per cent by weight of alkaline cleaner and the remainder water) maintained at a lukewarm temperature to prevent excessive lather. Finally they are washed in Tank 4, containing plain hot water to rinse the cases thoroughly and quicken drying. The cases are then ready for the following redraws.

The first redraw is performed in the same manner as the cupping operation using a mechanical press equipped with a dial feed. Seventy tons are required to perform this operation, and a drawing speed of 65 ft. per min. is used. The reductions taken on this redraw are 35 per cent at the bottom of the case and 60 per cent at the top of the side wall. Figs. 6 and 7 show the set-up for this operation and the final first redraw dimensions.

Hydraulic Press for Second Redraw

The second redraw operation is done on a high-speed hydraulic press; the work is fed into the die (Fig. 8) manually as the stroke required gives the operator ample time to have the work ready for the next stroke of the press. This operation requires approximately 35 tons working pressure, and the drawing speed used is 40 ft. per min. The reduction in wall thickness varies from 40 per cent at the bottom of side wall to 50 per cent at the top. For final second redraw dimensions see Fig. 9.

The third and final redraw (Fig. 10) is carried on in the same manner as the previous operation with the exception that the working pressure required is 30 tons and the drawing speed 35 ft. per min. The reductions (Fig. 11) taken here are from 50 per cent at the bottom of the side wall to 30 per cent at the top. This governs the final physical requirements of 85,000 lb.

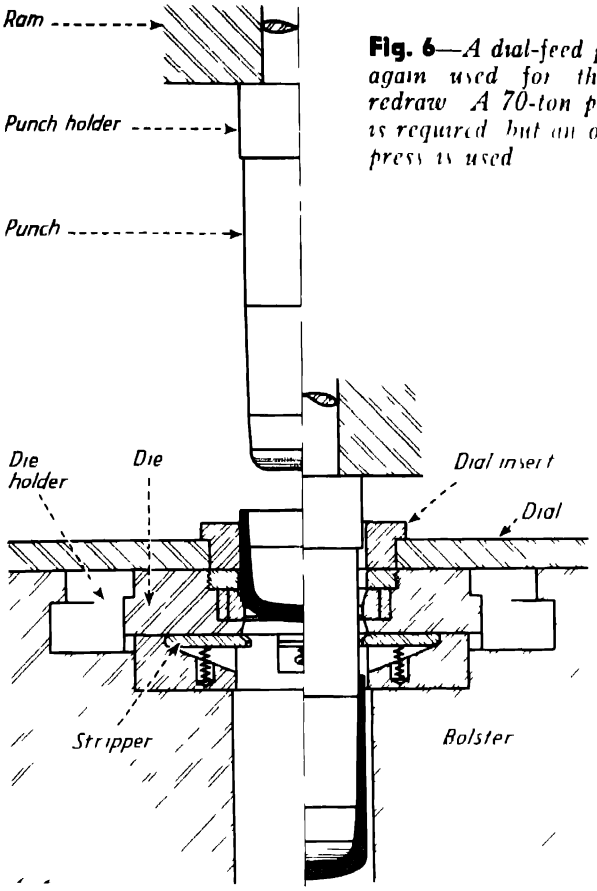
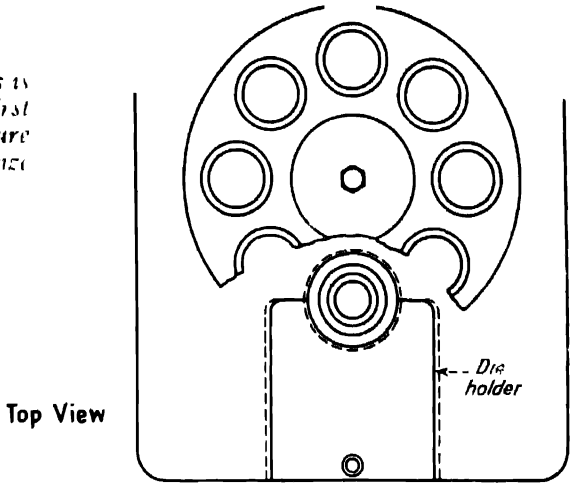


Fig. 6—*A dial-feed press is again used for the first redraw. A 70-ton pressure is required but an oversize press is used*



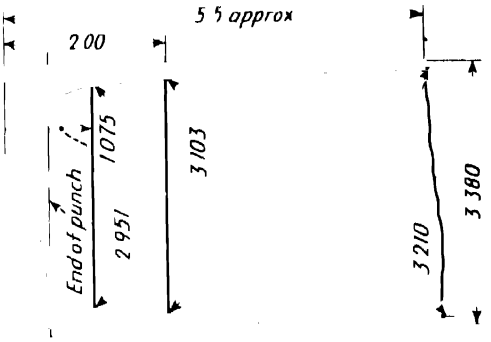


Fig. 7—*Dimensions of the first redraw show a 35 per cent reduction at the bottom 60 per cent at the top*

Fig. 8—*The case is hand fed into the die because the length of the stroke renders dial feed unnecessary*

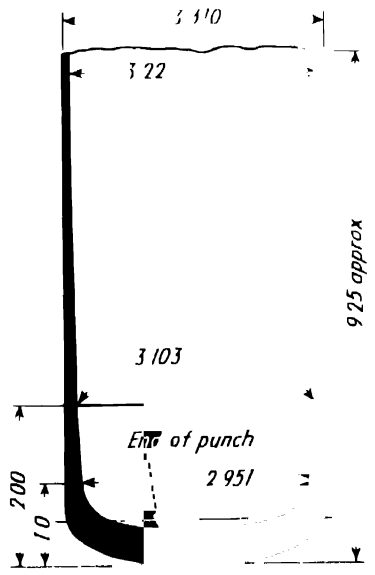
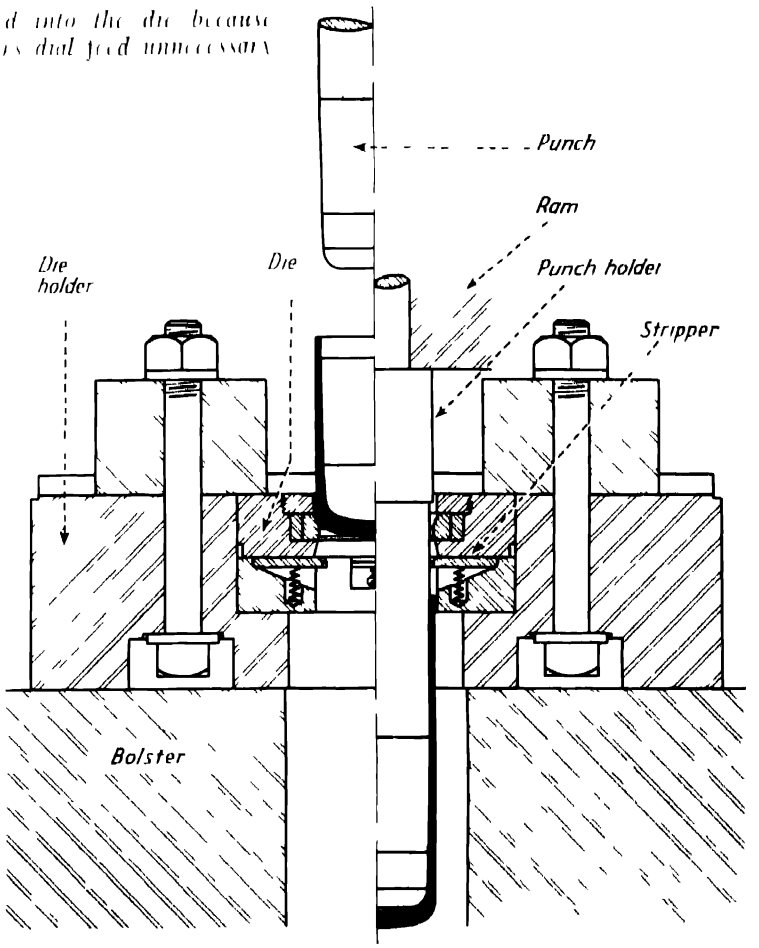


Fig. 9—*Dimensions of the 75-mm case after the second redraw show reductions varying from 40 per cent at the bottom to 50 per cent at the top*



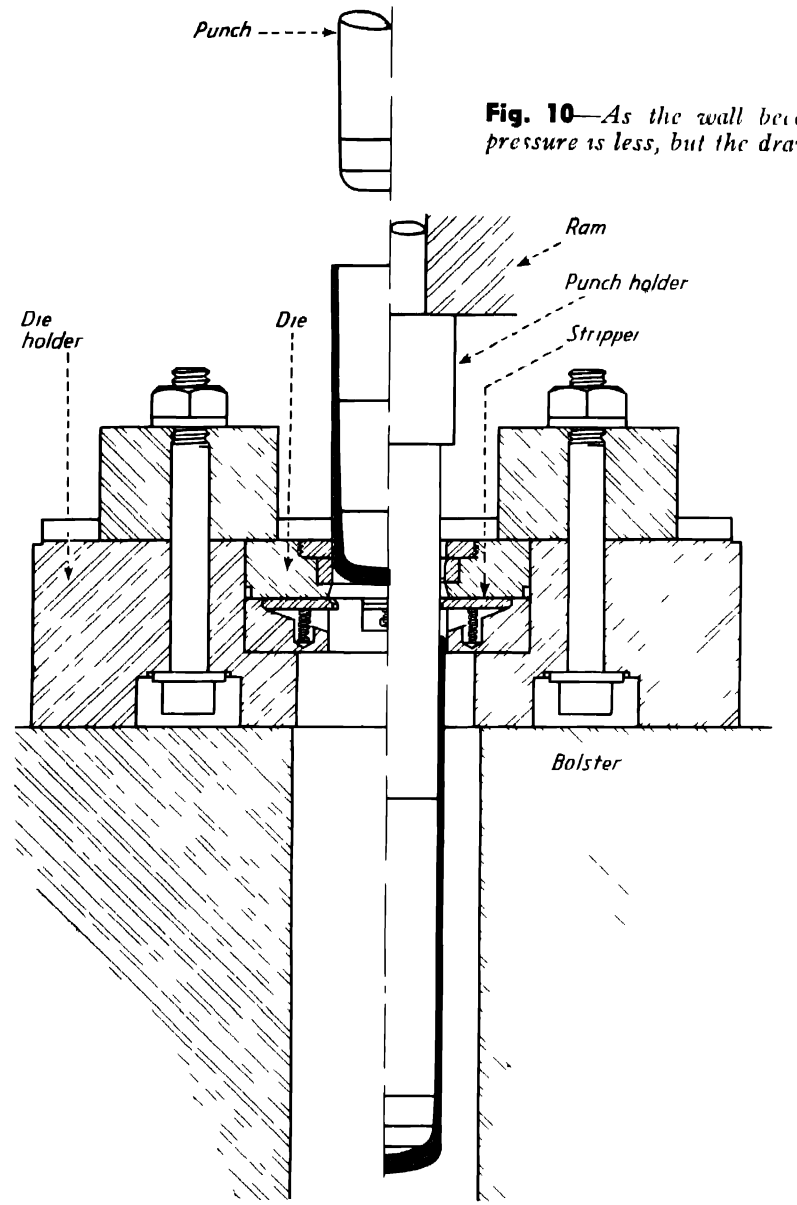


Fig. 10—*As the wall becomes thinner, the required pressure is less, but the drawing speed must be reduced*

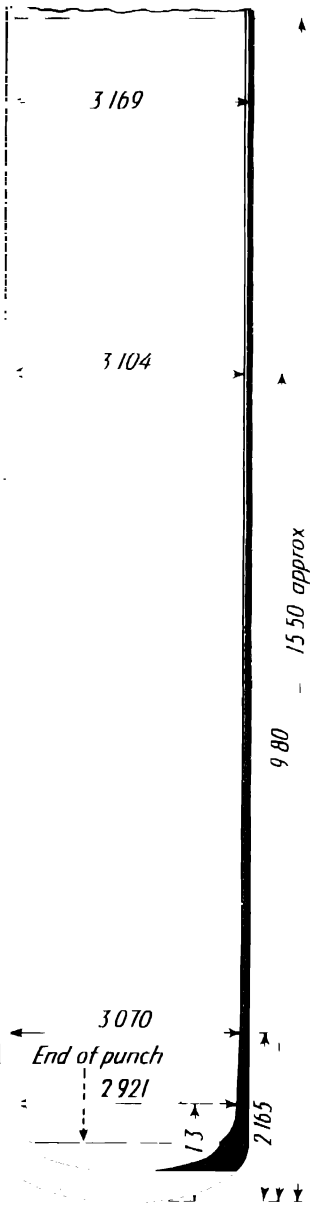


Fig. 11—*If the case is given proper press work, it will have a strength of 85,000 lb. per sq. in. after the third redraw*

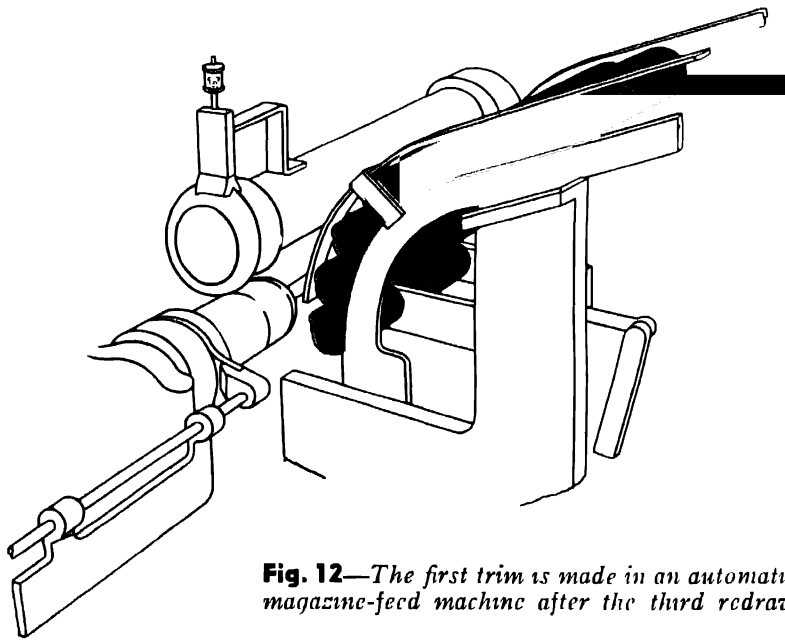


Fig. 12—*The first trim is made in an automatic magazine-feed machine after the third redraw*

per sq. in. tensile strength near the bottom of the side wall.

Before leaving the drawing operations, it might be well to mention that all the presses used are equipped with forced feed lubricant pumps with the exception of the cupping press where the disks are dipped by hand into the lubricant pan and placed into the bushings of the dial feed ready to be fed under the punch.

Carbide insert dies are used throughout because of the severe reduction and high production of the presses. This type of die requires less maintenance because the damage from brass pick-up and die wear is less.

After each drawing operation, the cases are washed in hot water in individual tanks at the presses to remove drawing compound and loaded into the annealing baskets. On the way to the furnace, they are again washed in a central washing tank containing hot water. This insures unspotted clean-finished cases.

Following the third redraw, the cases are ready for the first trim of the mouth end of the case. This operation is performed on an automatic end-trimming machine equipped with magazine feed as shown in Figs. 12 and 13.

After the cases are trimmed to the dimensions shown in Fig. 14, they are ready for the heading and indenting operation that is performed on a 1,000-ton hydraulic heading press equipped with a six-station dial feed. See Fig. 15. The base of the case is given a light coat of beef tallow or drawing compound paste to facilitate the spreading of the metal toward the outer edge while the pressure is being applied

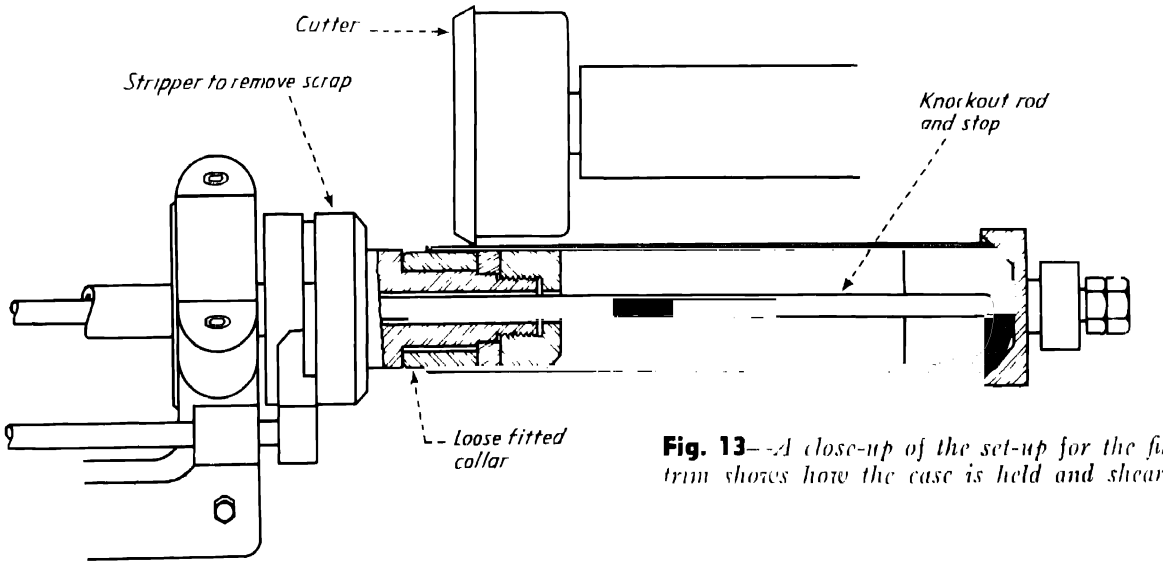


Fig. 13—*A close-up of the set-up for the first trim shows how the case is held and sheared*

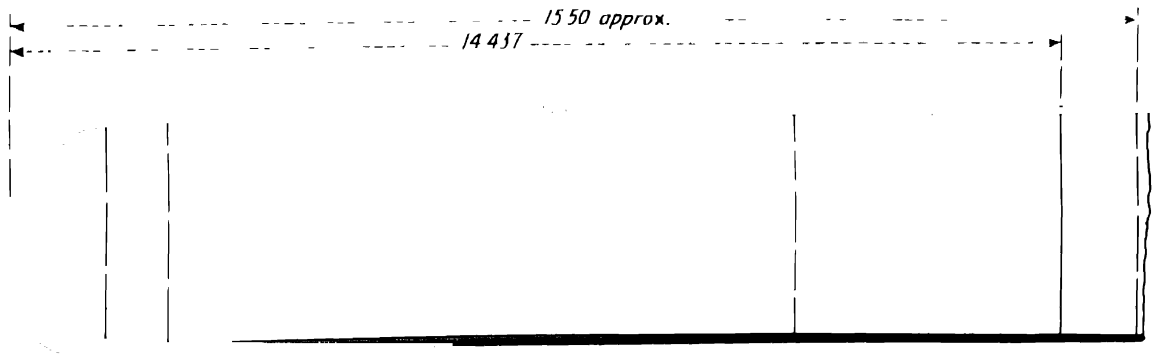


Fig. 14—*These are the trimming dimensions, which make the shell ready for the heading operation*

by a heading bumper having a ¾ deg. convex angle along its face.

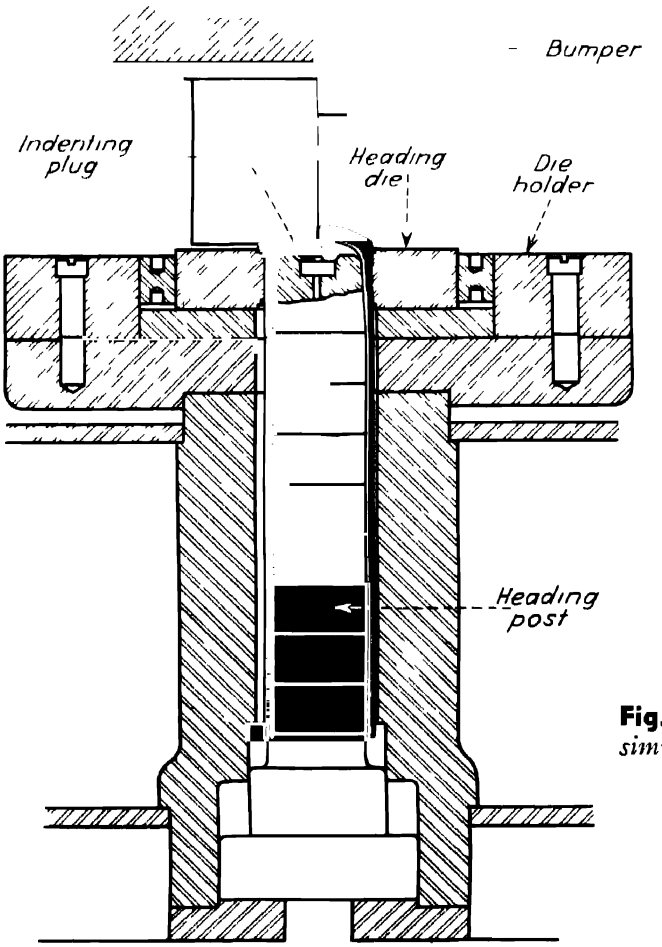
The indenting of the primer hole is done to prevent expansion of the primer seat during service. This operation is performed in conjunction with the heading operation by inserting a plug into the primer boss cavity of the heading nose. The dimensions of this plug are 0.480 in. at the base and 0.310 in. in length, pointed to a $\frac{3}{32}$ in. radius at the point. This plug so displaces the metal as to give a Brinell hardness of 130 to 140 (using a 15-kg. load and $\frac{1}{16}$-in. steel ball) just beyond the walls of the finished primer hole.

After a case is headed by the bumper, which exerts a pressure of 675 tons, it is indexed to the unloading station and ejected as shown in Fig. 16. Care should be exercised during this operation to see that no cold shuts or folds are present on the inside radius of the case that might cause separation of the head from the side wall during service. Dimensions appear in Fig. 17.

Following this operation, the cases are ready for body annealing to help ease the tapering without caving in of the sidewall. The cases are placed in an annealing rack and submersed mouth down into molten salt-peter at a temperature of 950 F. to a depth of 9 in. They remain in this bath for 1¾ min.

Consequently, since no hole is provided for the escape of air as the cases are immersed in this bath, an air vent fixture was made as shown in Fig. 18.

Immediately upon completion of this anneal, the work is raised by an air hoist and plunged into a cold water bath in order to remove the molten salt-peter. The cases are finally rinsed in hot water



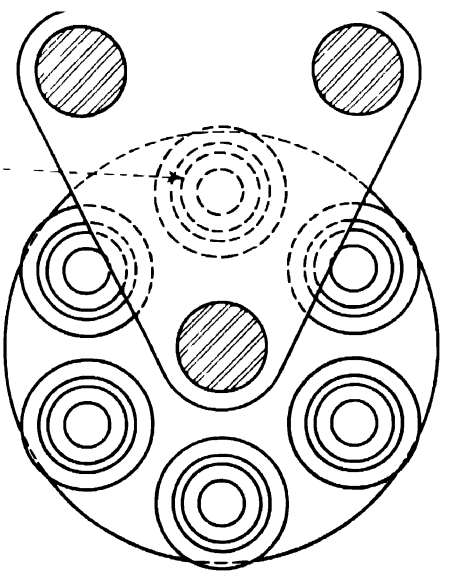


Fig. 15—*Heading and indenting are performed simultaneously in a dial-feed hydraulic press*

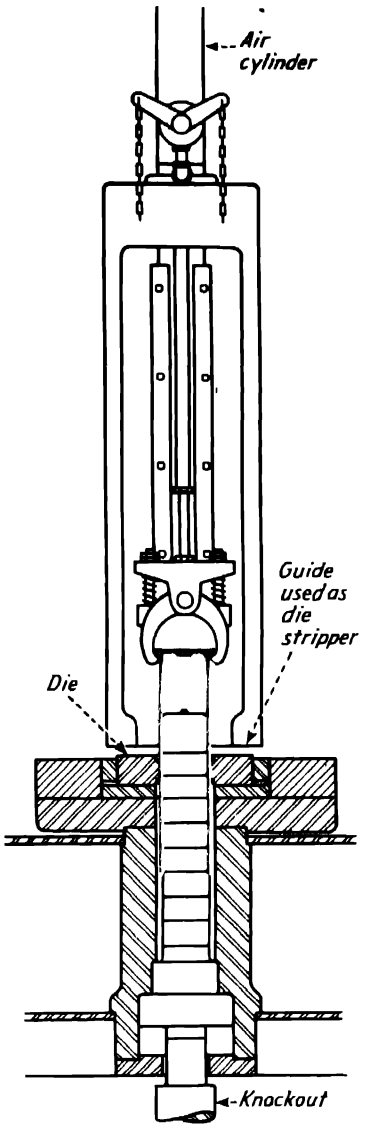


Fig. 16—*A pneumatically operated gripping device lifts the case from the heading die*

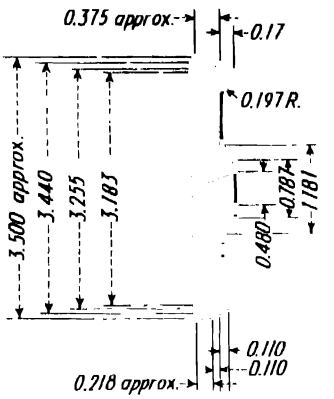


Fig. 17—*Dimensions of the head and indentation show how the accumulated metal is forced into its proper place*

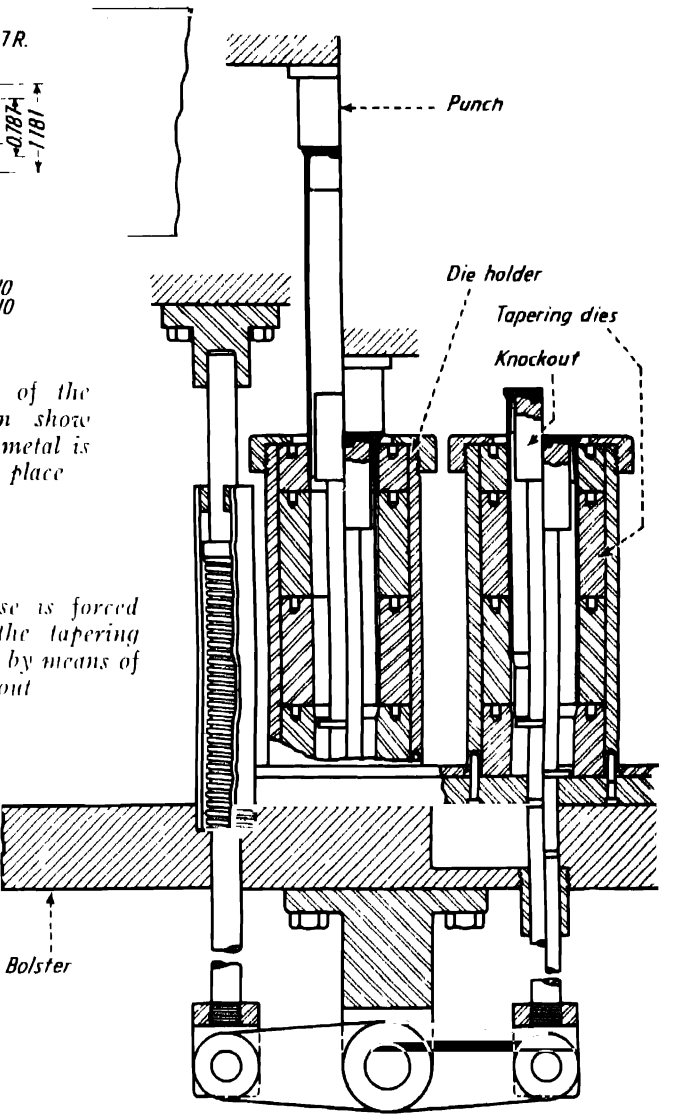


Fig. 19—*The case is forced downward into the tapering die and then freed by means of a knockout*

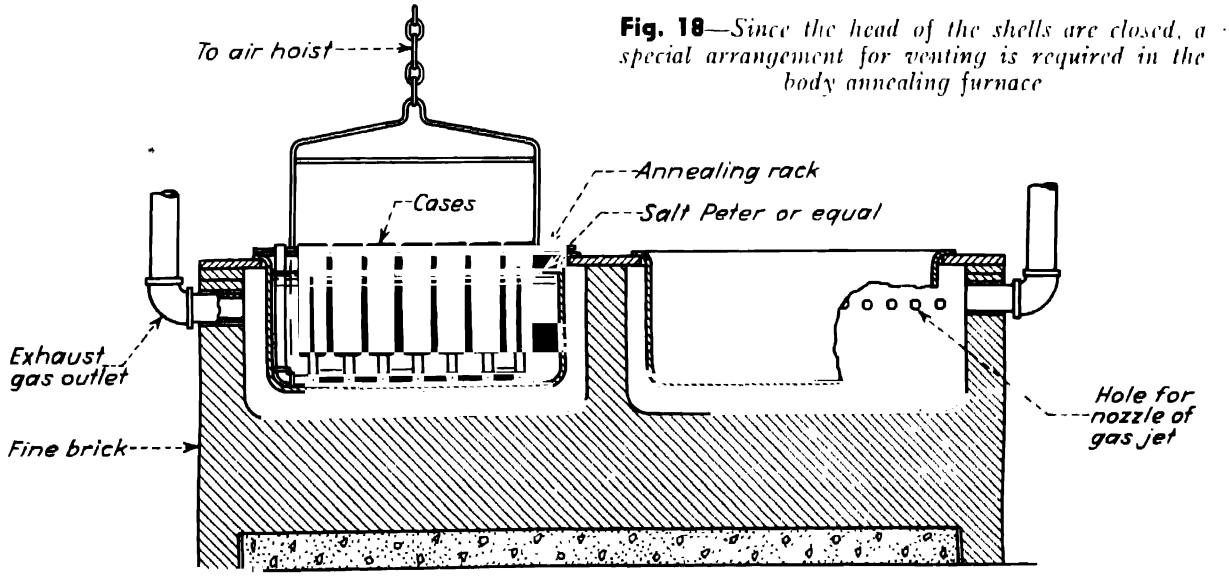


Fig. 18—*Since the head of the shells are closed, a special arrangement for venting is required in the body annealing furnace*

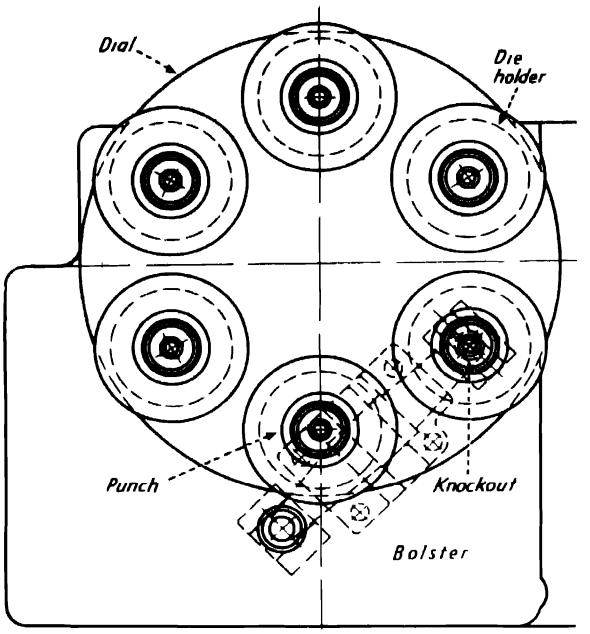


Fig. 20—*A plan view shows how the rocker arm extending from the work station to the ejector station operates the knockout*

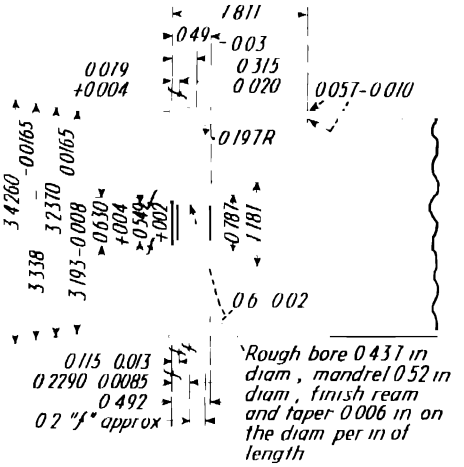


Fig. 23—*Head dimensions are more precise than any others in the case. The limits are as shown in the sketch*

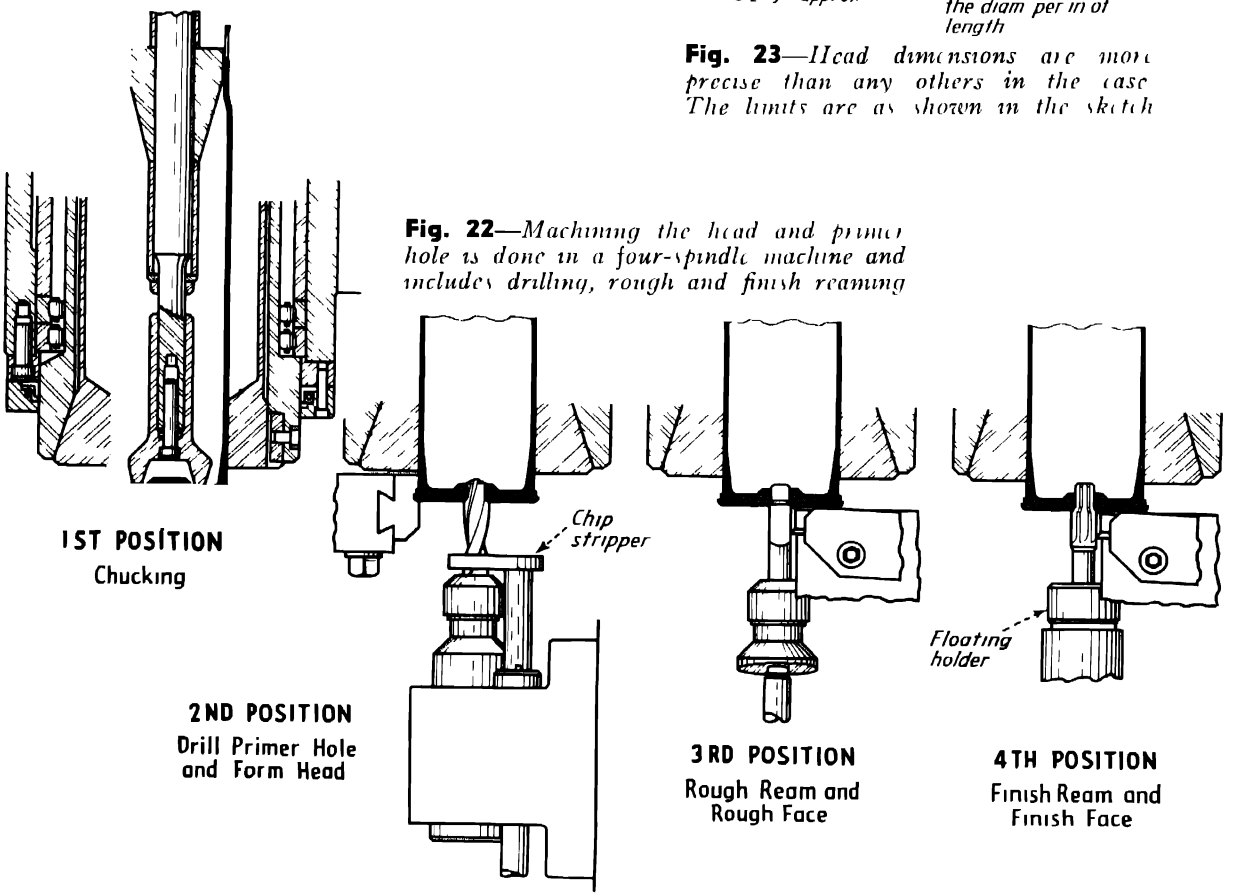


Fig. 22—*Machining the head and primer hole is done in a four-spindle machine and includes drilling, rough and finish reaming*

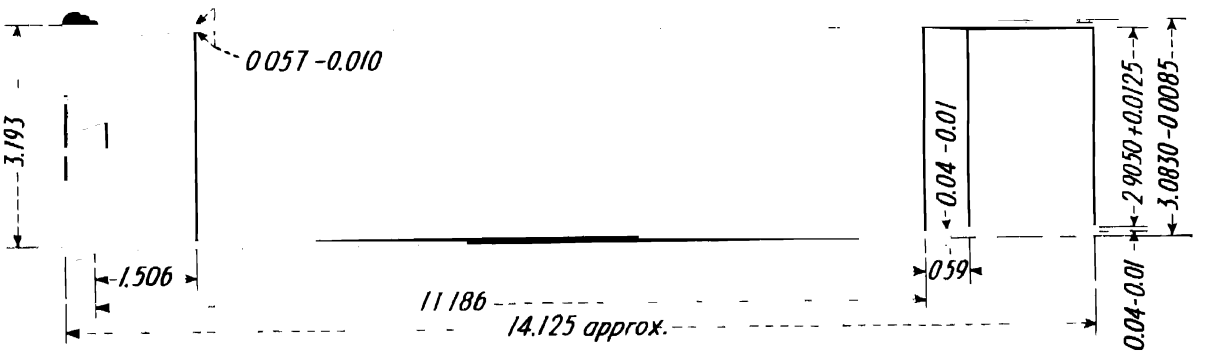


Fig. 21—*After the case has been tapered the dimensions are as shown below*

to aid drying prior to the tapering operation.

For the tapering operation, the side wall is lubricated with a combination of 25 per cent soluble and 75 per cent lard oil. Each case is then placed mouth down in the die of a six-station dial-feed mechanical press and fed under the bumper automatically. It is forced into the die as shown in Figs. 19 and 20 and tapered to final dimensions of the finished case (Fig. 21).

Each case is stripped from the die by a rocker arm at the bottom of the press extending from the work station to the ejecting station. This is also shown in Fig. 20.

This operation requires approximately 20 tons and a ram speed of approximately 60 ft. per min.

After they are tapered, the cases are ready for the final machining of the head and primer hole. This operation is done on a four-spindle horizontal chucking machine. The sequence of the machining operation is clearly shown in Fig. 22.

When the head and primer hole have been finish machined to dimensions shown in Fig. 23, the cases are trimmed at the mouth on a two-spindle drill press as shown in Fig. 24. The final trim size is 13.82-0.04 in over-all.

The cases are then washed in an alkaline cleaner to remove the grease and oil accumulated from tapering and machining operations. This is done to prevent unnecessary stains on the finished case when mouth annealed.

The final mouth anneal is carried on in the same manner as the anneal for taper

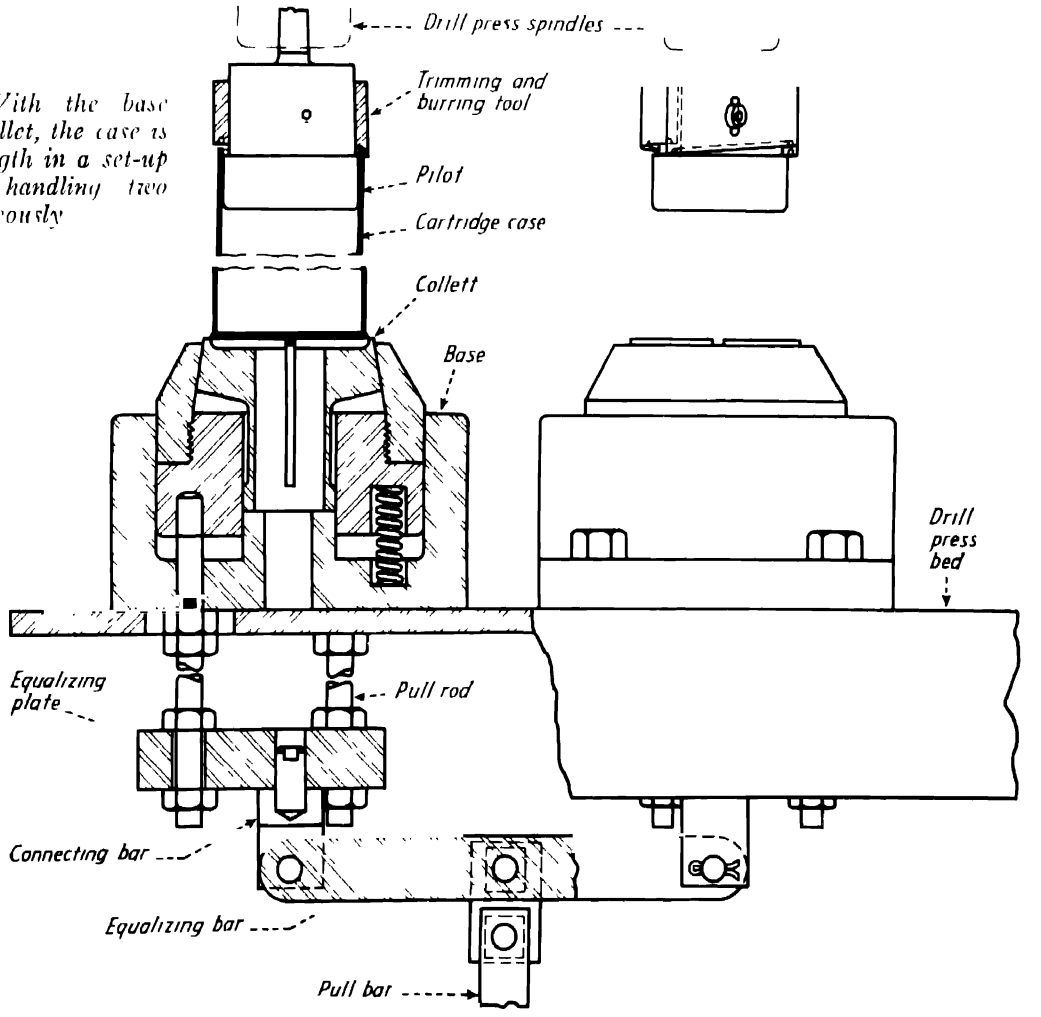


Fig. 24 — *With the base gripped in a collet, the case is trimmed to length in a set-up arranged for handling two pieces simultaneously*

with the exception that the cases are immersed at the mouth 2⅛ in. for 2½ minutes. The air vent is unnecessary as the cases have the primer hole in the head of the case. At the completion of this anneal they are submersed in the cold water tank, then in an alkaline cleaner and rinsed off in hot water to dry. The annealing operation is done to make the metal at the mouth ductile enough to prevent setting up excessive strains in the metal that will cause season cracking after the projectile is inserted and the complete round placed in storage.

Following this operation, the cases are ready for the stress relief anneal. A conveyor-type furnace is used for this operation, the cases being charged at one end and discharged at the other.

The cases are stored on trucks to be cooled and are then ready for inspection. At the completion of the inspection, they are stamped (Fig. 25) and packed, ready for shipment.

The views expressed in this article are solely those of the writer and in no way reflect the attitude of the War Department. The statements made and figures quoted are not from official sources

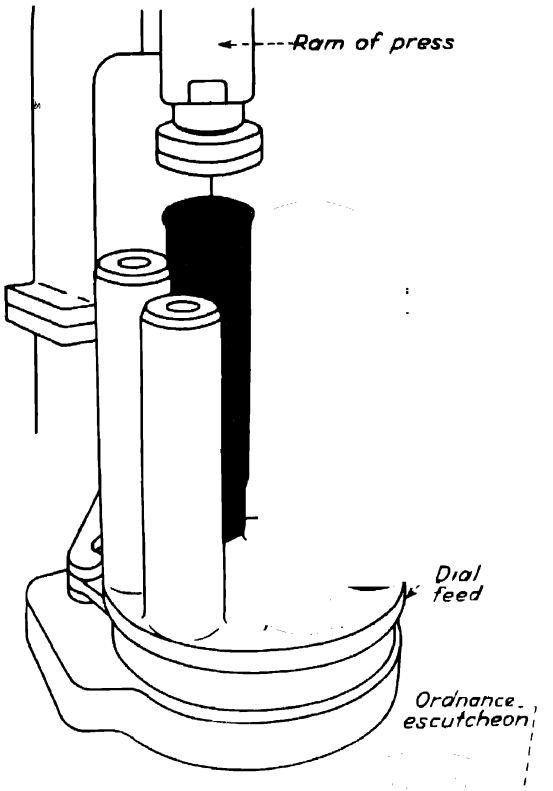


Fig. 25 — *Cases are stamped in a dial feed press for the final operation before packing*

No.	Operation	Machine Used	No.	Operation	Machine Used
1	Cupping	*250-ton Crank Press	13	Anneal for Taper	Salt Peter Furnace 2 Tanks
2	Anneal & Cool	Furnace			
3	Pickle & Wash	Pickling Basket 3 Wooden Tanks 1 Lead Lined Tank	14	Taper	*70-ton Crank Press
			15	Finish Machine Head & Primer Hole	4-Spindle Auto Chucking Lathe (Horizontal Type)
4	1st Redraw	*175-ton Crank K Press			
5	Anneal & Cool	Same as Operation No. 2	16	Final Mouth Trim	2 Spindle Drill Press
6	Pickle & Wash	Same as Operation No. 3	17	Wash	3 Wooden Tanks
7	2nd Redraw	150-ton Hydraulic Press	18	Final Mouth Anneal & Wash	Salt Peter Furnace 4 Wooden Tanks
8	Anneal & Cool	Same as Operation 2			
9	Pickle & Wash	Same as Operation 3	19	Stress Relief Anneal	Continuous Draw Furnace
10	3rd Redraw	75-ton Hydraulic Press			
11	1st Trim	Auto. Trimmer	20	Inspection	
12	Head and Indent	1000-Ton Hydraulic Press	21	Stamp & Pack	*70-ton Crank Press

*Tonnage Rating at bottom of stroke

Correcting Machine Tool Lubricating Troubles

Courtesy of Socony-Vacuum Oil Company, Inc.

THE PROPER LUBRICATION for any given machine tool depends upon the duty involved and the method used for applying the grease or oil. However, any oil used must meet definite requirements of viscosity, ability to flow at low temperature, and resistance to breakdown in service. Body or viscosity must be sufficient to prevent metal-to-metal contact, but must not be so heavy as to cause high internal friction or to fail to penetrate the close clearance involved. Breakdown resistance must be sufficient to prevent decomposition or gumming under continuous service. It is also important that any oil used be free of impurities which might injure machine parts or oiling mechanism. Acid, for instance, will cause pitting of highly polished surfaces.

But troubles frequently occur which are traceable to the lubricant, method of applying it, or to the mechanical condition of parts of the machine tool. These troubles are listed below; each suggests its own remedy.

TROUBLES TRACEABLE TO LUBRICANT

1. Dirty container or lubricant contaminated
2. Lubricant does not have the proper physical characteristics
3. Lubricant is emulsified
4. Water in the bearing or reservoir
5. Mineral oil added to a compounded oil, or different compounded oils added to each other. (Fresh mineral oil added to a compounded oil containing blown vegetable oil has a tendency to sludge. Mixing different compounded oils together may also cause sludging)
7. Lubricant been too long in service

TROUBLES TRACEABLE TO METHOD OF APPLYING LUBRICANTS

1. Oiling devices and supply pipes not clean and choked
2. Lubricant not being fed in sufficient quantity
3. Oil level too low in a splash oiled bearing
4. In bearings requiring wool or silk packing lint from cotton waste or rags may have entered the bearing
5. Incorrect grooving and chamfering
6. Incorrect application of lubricant
7. Imperfect distribution of the lubricating film. Lubricant may have to be applied at more than one point on the bearing surface
8. Ring or chain in a ring or chain oiled bearing broken
9. Felt pads glazed or fallen from journal
10. Wicks have insufficient strands, or are not clean
11. Ball or roller bearings housings too full of lubricant

TROUBLES TRACEABLE TO MECHANICAL CONDITIONS

1. Change in the load conditions necessitates a change in the lubricant
2. Improper clearance between the journal and bearing (if too tight the lubricant can't get in, and if too loose the lubricant will not be retained)
3. Belt or rope drives too tight
4. Equipment out of alignment
5. Vibration due to unbalance
6. In brass bearings, lubricant escaping between the brass and housing. Brass warped
7. Bearing cracked or rough
8. Bearing cap loose or out of line.
9. Bearing of insufficient size to carry the load
10. Foundation of the equipment shifted
11. Bearing material excessively sensitive to temperature variations
12. Insufficient means of proper heat transfer from the bearing

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Speeds and Feeds for Turret Lathes

Courtesy of Warner & Swasey Company

HARD AND FAST rules for turret lathe speeds and feeds cannot be set without exact information on the following items

1 Type of machine used
2 Condition of the machine
3 Form of cutting tool
4 Brand of cutting tool
5 Method of mounting the tool
6 Analysis of the material to be cut
7 Method of holding the work
8 Type of cutting lubricant

However speeds and feeds for different materials fall within definite ranges Some of these are listed in the accompanying table for ram type and saddle type turret lathes, using high speed steel, Stellite J, and carbide cutting tools Obviously, they are for broad general use and subject to change with variables occurring in both tools and material

The table is a guide when starting work on the materials listed The operator should start his machine at or near the highest surface speeds and feeds given, and watch the cut for a few turns The color of the chip and "feel" of the machine will determine whether the speed and feed are correct, or whether they should be increased or decreased Experience shows that speed of cutting steel is nearly correct when the chip is of straw or light yellow color, should the chip be blue, it is too hot, and the speed or feed, or both, should be decreased No speed or feed should be used that causes the lathe to vibrate

Since the table gives cutting speed in surface feet per minute, the operator must set the rotational speed of the lathe spindle in accordance with the diameter of the work Tables for converting surface feet per minute into revolutions per minute for various diameters are available in most handbooks However, the conversion can be made by applying the formula

$$R = 3.8197\ S \div d$$

where R = rotational speed, r p m , S = peripheral speed, surface ft per min , d = diameter of work, in Conversely, $S = 0.2617Rd$

CONDENSED TABLE OF SPEEDS AND FEEDS FOR TURRET LATHES

	SURFACE FEET PER MINUTE						FEEDS			
	H S S ‡		Stellite J		Carbide		Ram-type machine		Saddle-type machine	
Material	*Rough*	*Finish*	*Rough*	*Finish*	*Rough*	*Finish*	*Rough*	*Finish*	*Rough*	*Finish*
Cast iron	50-60	80-110	90 120	130 160	180-200	350 400	0 016 0.025	0 016 0 025	0 032 0.060	0 032-0.125
Semi-steel hard	40-50	65 90	75 100	100 130	140 160	250-300	0 016 0 025	0 016 0 025	0 032-0 060	0.032-0.125
Malleable iron †.	80 110	110 130	120 140	150 200	250 300	400 500	0.016 0 025	0 016 0 025	0 032-0.060	0.032-0.060
Steel casting (0.35 carbon) *	45-60	70 90	70 80	90 130	150 180	200 250	0 010 0 020	0 012 0 020	0 018 0 030	0 018-0 045
Brass (commercial 85-5 5)	200-300	200-300			600 1000	600 1000	*Maximum feed of machine*			
Bronze (80-10 10) *	110 150	150-180			600	1000	0 016 0 030	0 010-0.016	0.016 0.050	0 010-0.030
Aluminum **	400	700			800	1000	*Fine feeds to produce good finish*			
SAE 1020 * (Coarse feed)	60-80	60-80			300	300	0 020 0.030	0 020 0.030	0 024-0 044	0.024-0.044
(Fine feed)	100-120	100 120			450	450	0.007 0 020	0 007 0 020	0 010 0.030	0.010-0.030
SAE 1035 *	75 90	90 120			250	250	0 020 0.030	0 020 0 030	0 024-0 044	0.024-0.044
SAE-X-1315 *	175-200	175-200			400 500	400-500	0 010 0 015	0.010-0 015	0.010-0.015	0.010 0.015
SAE 1050 *	60-80	100			200	200	0 012-0 020	0.012-0.020	0.025-0.090	0.015-0.045
SAE 2315 *	90-110	90-110			300	300	0 012 0.020	0.012 0.020	0.025-0 090	0.015-0 045
SAE 3150 *	50-60	70 90			200	200	0 012 0 020	0.012-0.020	0.025 0 090	0.015-0.045
Stainless steel * (Selenium content)	100-120	100-120			240 300	240-300	0.010 0 015	0 010-0 015	0.010-0 015	0.010-0.015

‡ Water soluble oil lubricant. ** Kerosene lubricant † Cobalt 18 4 1

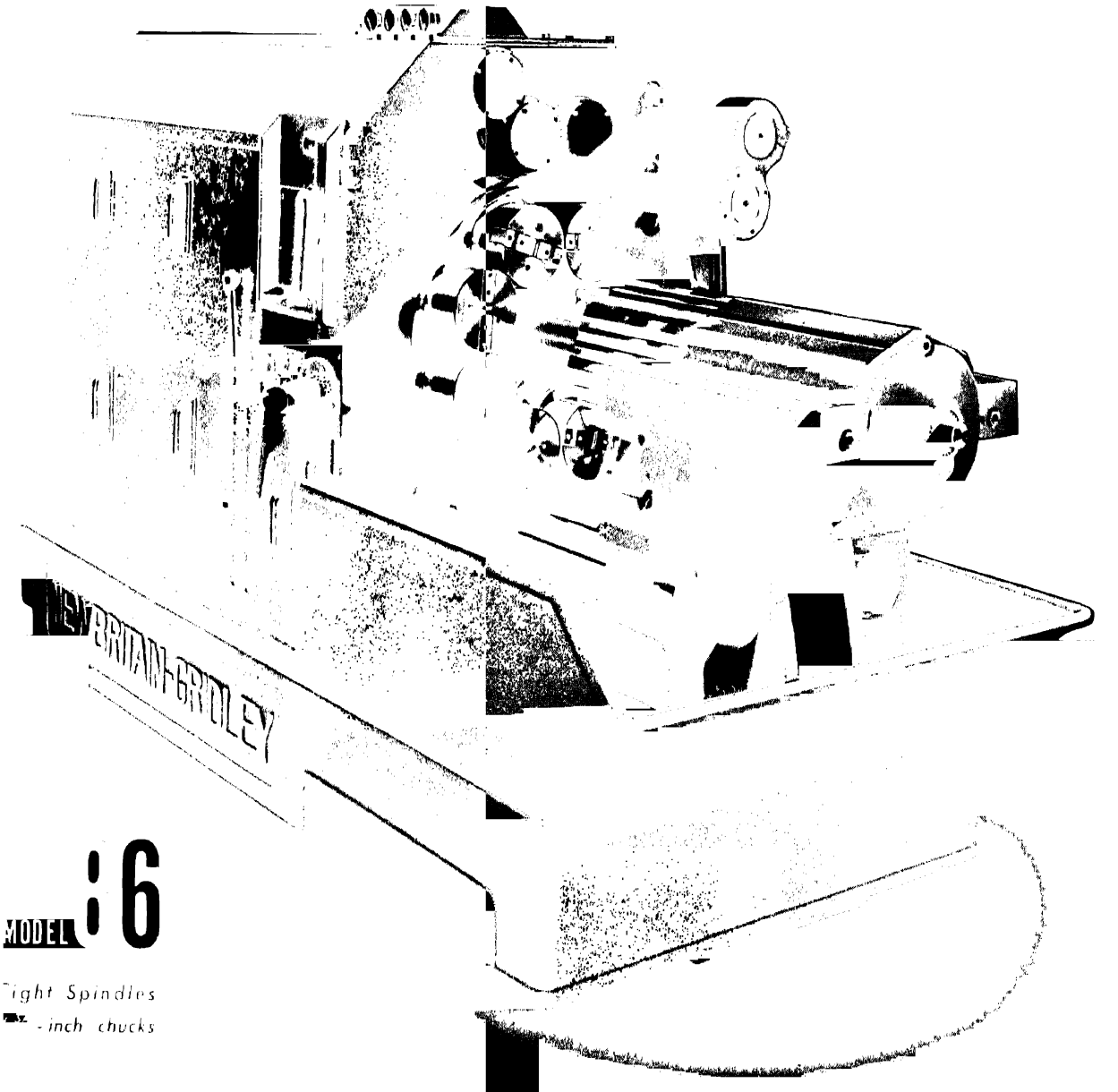
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Keep Prices in Line

PRICES are under inspection as the defense program moves along. That fact should not cause surprise. It should be welcomed.

With billions being spent for armament, the American people want to be sure they are getting their money's worth. It would be extremely costly to have an upward spiraling of prices which probably would result in a crash such as occurred after the World War. Moreover, the public would resent anything that resembled profiteering at a time when manpower was being conscripted for national service. However you look at it, any general upswing of prices would be cause for alarm and would provoke public disapproval.

For those reasons industry has a grave responsibility for doing everything within its command to guard against major price advances. Yet it would be foolish to lay down the rule that all increases are outlawed. No doubt there are cases where materials costs, labor rates and design improvements make price advances imperative if the manufacturer is to earn a modest profit. It would be unfair and unfortunate if such cases were used as an excuse by unsympathetic interests to start a witch-hunt against industry. We don't believe responsible officials in Washington have any such intention.

So that no misunderstandings may arise we suggest that the proper authorities within the Defense Commission investigate each individual case of alleged excessive prices to get at the facts before they come to any conclusions. It is so easy to be misled.

Let's take a hypothetical case of a machine tool. Suppose the Navy is quoted a stated price which might be considerably higher than for the same general type of machine five years ago. Before one could say that the price advance was not justified, a certain set of questions should be answered.

Was the previous machine exactly like the one to be built? Does the new machine contain any added features of construction not possessed by the earlier machine, thus running up production and materials costs? What are the materials costs today compared with five years ago? Are labor rates up or down today as against then, and how much overtime pay is involved? What is the production guarantee of today's machine? Won't it turn out a lot more work than the machine of five years ago, and better work too? These are only a few of the questions which must be answered before one can say that prices are out of line.

While responsibility for careful investigation rests upon the government before making charges that manufacturers are "sticking" the army and navy, industry itself has the responsibility for seeing that the government is not stuck. Only irreparable harm can come to industry as a result of undue price increases. The Defense Commission has the power of overwhelming public opinion to use against any manufacturer who is so unwise as to violate the trust which is his today. It also can dig up good law to back up its stand. The manufacturer who flies in the face of these danger signals is no friend of industry. In fact, he is not even his own friend.

Burnham Finney

GAGING BUSINESS

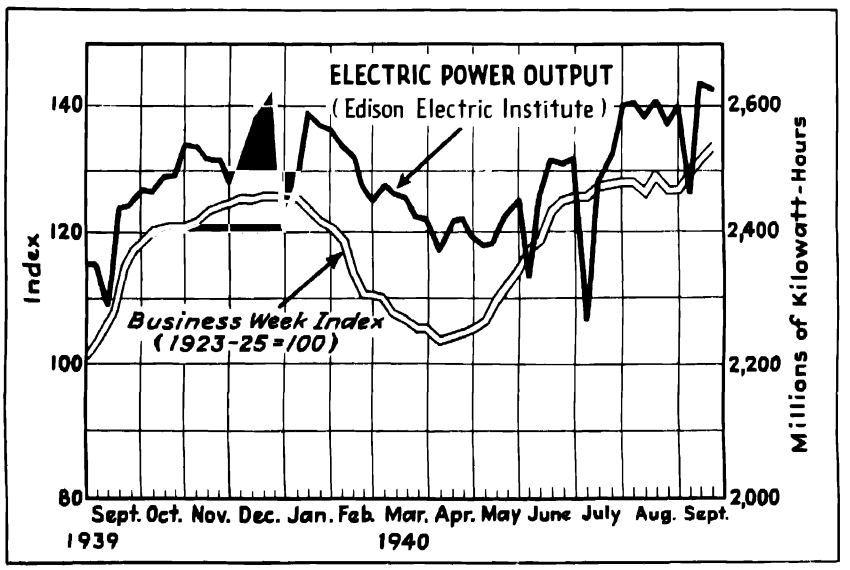
Defense orders, plus British and Canadian, call for machine tools totaling $750,000,000. Industry will be producing machines at rate of $500,000,000 annually before end of the year

Machine Tools—Defense orders for machine tools, based on the program already planned, with British and Canadian business added, will climb to an estimated total of $750,000,000. If the defense program is broadened further and the war should last several years, machine tools needed for armament purposes will far surpass that figure. Today machine tool builders are turning out equipment at a rate of about $450,000,000 a year and before the end of 1940 will have expanded production onto a basis of $500,000,000 annually. Machine tool bookings for munitions projects piled up during September in a volume far exceeding operating capacity, and deliveries now are strung out over the next year. The voluntary priority system put into effect on machine tools for armament work makes it almost impossible for the time being for a company fabricating peacetime products to secure new equipment. Machine tool builders themselves who need new machines badly to increase output required by companies with munitions contracts are being given preferential delivery over all others on authority from Washington. Hundreds of machine tools to which foreign governments (Japan, Russia, France, Netherlands East Indies) have title but which the Army and Navy refuse to allow exported are still on the docks at seaboard waiting for Congress to pass the necessary legislation so that they can be taken over by the government for defense purposes. Wright, Pratt & Whitney, Chrysler, Ford and General Motors are among the big purchasers of machine tools for armament manufacture.

Steel—Mill backlogs are so heavy that virtually full capacity operations will prevail for months ahead. No expansion of open-hearth facilities is believed necessary to meet defense requirements. A possible shortage in electric furnace steel capacity is currently being remedied by installation of additional furnaces. Alloy steel made by the electric furnace process will be particularly in demand for airplanes and armor plate. Republic Steel, now increasing its electric furnaces, expects to produce large tonnages of armor plate for tanks. Bar mills for production of shell forge stock may have an overload later on unless orders are reasonably spread out.

Aircraft—About 19,000 planes of all types will be produced in the U. S. in the 12 months which began July 1. In that same period around 25,000 engines will be built. When sufficient engine capacity is available, approximately five motors will be made for every two planes. Output of military planes, now estimated at 750 a month, should be up to 1,400 a month by next summer. Curtiss-Wright has received plane orders totaling $94,161,701 from the Army Air Corps. North American Aviation's recent awards from the War Department amount to $72,857,049. The industry's unfilled orders now are well over the two billion mark. Present program is for Britain to get pursuit ships first and the U. S. to take training planes second. Third in preference are said to be bombers for England. Plans for making nine-cylinder engines at Wright Aeronautical's new Cincinnati plant have been abandoned in favor of a 14-cylinder job. Allison is producing 200 motors a month now and will be up to more than 400 motors a month within the next 90 days.

Munitions—The War Department has contracted for over $1,000,000,000 of ordnance material the past 10 days, the armament program having been perceptibly speeded up. Of that total almost $250,000,000 went for ammunition and ammunition components and $75,688,245 for tanks. Pullman-Standard will build medium-weight tanks for the British and 2,306 mortars (81 mm.) for the U. S. at its Hammond, Ind., plant, which was a large producer of munitions during the World War. In addition to a contract for some 70,000 machine guns of various sizes, General Motors will manufacture shell on an important scale at Oldsmobile and Chevrolet. The War Department is asking companies with munitions contracts to provide air raid shelters for workers. The Department is considering storage of ammunition underground as a precautionary measure. Army arsenals have increased their output 30 per cent recently as a result of establishment of a 48-hour week. Packard Motor is tooling up more extensively for its 12-cylinder marine engine used for the Navy's so-called suicide speed boats. It now has orders for 267 and pending business includes 100 more for Britain, 30 for Canada and 81 for the navy. Production will be raised to two a day. American Car & Foundry is reported to have received an additional order for 12-in. shells for the British totaling $3,000,000.



TAKE ORDNANCE INVENTORY

WASHINGTON—The Army had 49,124 semi-automatic (Garand) rifles on hand August 1 and 191,435 on order It also possessed 471 3-inch anti-aircraft guns and had 117 on order. The status of other ordnance material on hand of Aug. 1 is as follows: field artillery, 75-mm. guns 241 with 1,230 on order; 75-mm. Howitzers 90 with 302 on order; 155-mm. long range guns, 4 with 92 on order; combat vehicles, scout cars, 525 with 1,887 on order; light tanks, 67 with 1,515 on order; medium tanks, 18 with 1,290 on order. Tractors, light tractors, 108 with 42 on order; medium 298 with 252 on order; heavy, 140 with 640 on order.

Government Plants, Under Contract Or Assigned, Reach $300,000,000

WASHINGTON—To the program of government-owned arms and munitions plants was added recently an award to Stone & Webster to build a $10,900,000 TNT and DNT plant, to be operated by du Pont. Four shipyards received awards to build government-owned facilities totaling $12,950,000. These awards bring the volume of government plant under contract or assigned to about $300,000,000 About $700,000,000 are provided in the War Department and other agencies for munitions plant construction. Plans for committing the balance of the sum are being worked out, and negotiations are under way with prospective private operators.

Reported as imminent are contracts with General Motors and Chrysler for building plants to turn out anti-aircraft guns. The plants will cost about $7,000,000 each.

Government-sponsored munitions plants are coming through under various financial arrangements which cannot be detailed in this space; about the only common denominator is that they are all to be privately operated. No breakdown is available as to proportionate cost of equipment and buildings, but it is safe to say the machinery is by far the major portion.

Other major government plant contracts are as follows: Savage Arms, Utica, N. Y., machine gun, $17,600,000; General Motors, Saginaw, Mich., machine gun, $20,000,000; Chrysler Corp., Detroit, tanks, $25,000,000; Carnegie-Illinois Steel Co., Pittsburgh, Navy guns, $2,275,000. The following firms will build shipbuilding plants: Consolidated Steel Co., Orange, Texas, $4,600,000; Seattle-Tacoma Shipbuilding, Seattle, $4,600,000; Manitowoc Shipbuilding Manitowoc, Wis., $1,000,000; Electric Boat Co., Groton, Conn., $2,750,000.

Manufacturers Must Give Preference To Army And Navy Orders Or Suffer Heavy Penalty

WASHINGTON—Conscription of industry, as finally passed, turns out to be, not bolshevism, but authorization for priorities What the famous Section 9 of the Draft bill does is put teeth into the power granted the President last June to give Army and Navy orders first call. It states that manufacturers must give preference to Army and Navy orders, at a price which the two departments consider reasonable, under penalty of having responsible officers go to jail for three years, paying a $50,000 fine, and seeing the plant taken over by the government at a "fair and just" rental

Navy was much impressed by this grant of power Without consulting the defense commission it rushed out with a statement that it expected "to conscript those materials or commodities under contract for delivery to non-essential purposes. The conscription . . . will relieve the owners from prior contractual commitments"

This is an interesting example of the friction still existing between the services and the defense commission, but it is probably not a particularly illuminating indication of future po' cy The commission has been building up its voluntary priority system, and has hopes that it can remain voluntary. The commission does want additional authority But what is wanted is not teeth in the present preference for military contracts The real problem now is to find a legal basis by which a sub-contractor can be told to give preference to orders from a prime defense contractor without involving the subcontractor in court battles with his less favored customers. The conscription bill offers no solution

If the defense commission is unable to find some legal precedents for preference ratings on sub-contracts, it is probable that additional legislation will be sought.

FEW FACTORY WORKERS IN DRAFT

WASHINGTON—Not many factory workers will be drafted immediately. Only 2 5 per cent of men within draft ages will be called at first and only a small percentage of them will be from factories For example, in a city of 100,000 the first draft will take about 40 men. If they are married they probably will be exempt anyway.



Ready For Service—*Are these modern 75 mm. field guns which have been manufactured at the government's Rock Island Arsenal. After final inspection in the assembly plant the guns are primed for possible action in the U. S. Army maneuvers*

Army Expansion Program Benefits Every Community; Orders Are Widely Distributed

NEW YORK—The industrial benefits of the Army's expansion program are reaching down into every American community. Protests from midwestern towns to the contrary notwithstanding, these communities, too, are reaping their share of the work and contributing their proportion of the raw materials. An order to an industrial concern in Hartford or Seattle seldom means that the work will be done in that particular city. On the contrary, it is more than likely that only a fraction will be done locally. Nor does it mean that management will derive the greatest gains. Statistics from typical organizations in the aviation industry tend to prove that labor, raw materials, and engineering costs take up the largest part of the aviation dollar.

These conclusions have been reached after a study of two typical organizations in the aviation industry—the large Boeing Aircraft Company in Seattle, which on August 30 received a War Department contract for 277 of its famous heavy bombing airplanes, the Flying Fortress, costing $70,449,955.20; and the Beech Aircraft Corporation, of Wichita, Kansas, which was given an award on August 28, 1940, for 150 training airplanes and 20 transport airplanes at a cost of $4,847,217.25.

Some observers indicate that the size of the corporation merely affects the extent of the job done in places other than the parent home of the company. The distribution is practically the same.

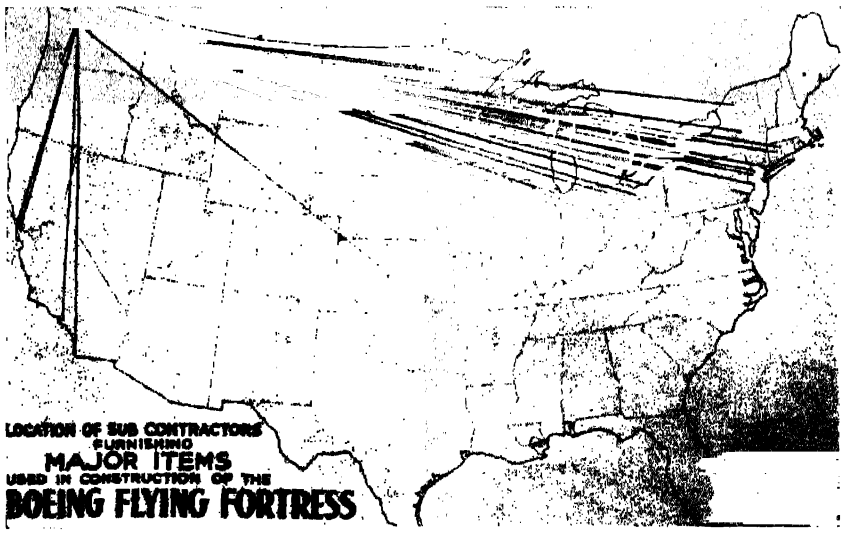
In a consideration of several features connected with the construction of the Boeing Flying Fortress, it is seen that the geographical sources of raw material used in its construction extend from Seattle to practically every state in the Union. The list of subconstractors and their addresses illustrates the same trend, for it indicates that plants everywhere are being mobilized to meet America's military needs in the industrial field.

Money Widely Distributed

The manufacturer's distribution of money received for aircraft during 1939 by the Beech Aircraft Corporation is especially instructive. The plant had a gross income of $1,300,000, yet the stockholders received nothing. The power plant builders got 20 percent, labor 16½ percent, engineering 10 percent, raw materials 7 percent—everyone profited but those who made the investment.

The national distribution of funds received in buying finished and raw material on the $619,000 spent by the Beech Aircraft Corporation in 1939, shows that 14 states in addition to Kansas contributed toward completing the Beechcraft model.

The division of labor and wages paid during the year point out the different types of employment called for in aircraft production. This Beechcraft job called for aircraft assemblying mechanics, engine mechanics, sheet metal workers, machinists, tool and die makers, painters, upholsterers, maintenance men, woodworkers, welders, and others. The mere mention of the trades also emphasizes the quality of skilled work demanded of aviation workers.



Coast to Coast—*A result of the Army's expansion program has been the coast to coast placement of orders in many and diverse industries. Above, most of the sub-contractors furnishing the major items in the defense schedule are, however, in Northeastern U.S.*

Military Supplies Can Be Provided By The Farm Equipment Industry

MILWAUKEE—The farm equipment industry is ready to contribute to national defense due to its many improvements in mechanization since World War I, is the indication presented recently at the Seventh Annual Meeting of the Tractor Division, Society of Automotive Engineers. Manufacturers of power farming machinery can provide military supplies in addition to normal products. Arthur Nutt, vice-president Wright Aeronautical Corp. and president of the SAE, emphasized the need for industrial preparedness beyond all other factors. A. Herrington, president, Marmon-Herrington Corp., also emphasized the need for preparedness and indicated that plants should be camouflaged and duplicates should be provided in case of destruction of the one in operation.

Many Export-Import Bank Loans Tied to Metal-Working Industry

WASHINGTON — Hitler started throwing his weight around Europe in the early '30s; the Export-Import Bank of the United States started making loans to South American countries in 1934—to save the Latins from going totalitarian under such trade tricks as ask! marks.

President Roosevelt signed the bill which increased the Export-Import Bank's present $200,000,000 revolving fund to $700,000,000, and authorizes the RFC to borrow an additional $1,000,000,000 to help finance the U.S. defense program. The only direct relationship between these two authorizations is that the Bank is a branch of RFC.

A list of commitments by the Bank to Hispanic countries from Feb. 12, 1934 to June 30, 1940, was spread on the record at Congressional hearings. It reads like a catalog of the metal-working industry: oil refining equipment, locomotives, cotton gins, machine tools, freight cars, road machinery, steel rails, equipment for steel mills, stokers, farm machinery, pipe, shoe machinery, pumps, motors, etc., etc.

During those years the Bank authorized a total of $436,900,000; $119,000,000 of that was canceled, and actual disbursements were only $162,000,000. Either a Latin government, or an American company negotiating a sale south of the border can approach the Bank for a loan. In nearly all cases of loss, the Bank takes it, not the exporting company. Jesse Jones, Federal Loan Administrator, testified that the United States can have no protection against losses due to repudiations or uprisings. But he said the losses would be well justified.

New Attempt to Organize Ford Begins Under CIO Leadership; $100,000 in War Chest

DETROIT—The United Auto Workers drive to organize Ford was given a new lease on life when Michael Widman assistant to CIO vice-president Allen Haywood, moved last week into the union's outpost on Michigan Ave just outside Dearborn Widman will report jointly to R J Thomas of the UAW and John L Lewis of the CIO These groups are contributing $50 000 apiece to a $100 - 000 war chest The money will be devoted to organization efforts at Ford in the Chicago district and in the aircraft and farm implement industries While possibly more skilled personnel is to be used in the new Ford drive the scope of the planned activities as compared with the money available would indicate that an 'all-out' attempt to unionize Rouge workers is not contemplated

Because of the growing importance of the aviation industry in the Middle West Walter Smethurst another Haywood assistant will make his drive headquarters at the UAW national offices in Detroit His activities will include attempts to organize the Stinson plant at Nashville Tenn and the Wayne Mich plant when the latter re-opens soon with 1 000 employees Continental at Muskegon also its Detroit plant when that is reopened Packard's Rolls-Royce plant when under way and the aircraft parts plants are other targets The UAW sees 100 000 additional members in the aircraft industry and 50,000 in the aircraft-parts industry as the prizes to be won

To finance its part of the deal with the CIO, the UAW is taking a referendum vote upon a $1 special assessment A move to raise dues failed While more militant than the United Rubber Workers the UAW may find that the $1 assessment will be hard to collect, even if voted In the recent annual convention of the Rubber Workers it was conclusively demonstrated that CIO union members will not pay monthly dues of more than $1 to support programs of their international officers that voluntary contributions cannot be counted upon to sustain organization efforts and that union members receiving the highest scale in the industry begrudge an extra 25 cents per month and refuse to do anything substantial about organizing their lower-paid competition

U. S. Government Contracts Awarded to Metal-Working Firms

(Other on page 774)

Contractor	Govt Agency	Commodity	Amount
Carnegie Illinois Steel Corp Wash D C	Navy	Steel Forgings	$214 775
Henry Disston & Sons Inc Philadelphia Pa	War	Armor plate	68 006
Midvale Co Philadelphia Pa	War	Tube forgings	101 080
Struthers Wells Titusville Corp Titusville Pa	War	Forgings	407 075
York Safe & Lock Co York Pa	War	Guns	719 198
Pressed Steel Car Co Inc Pittsburgh Pa	War	Forgings	119 832
American Locomotive Co New York N Y	War	Forgings	118 800
Pennsylvania Forge Corp Philadelphia Pa	War	Forgings	76 250
Struthers Wells Titusville Corp Titusville Pa	Navy	Shafts	82 362
Scovill Mfg Co Waterbury Conn	War	Body forgings	17 575
Harvey Metal Corp Chicago Ill	War	Body forgings	90 930
McCauley Steel Propeller Co Dayton Ohio	War	Propeller Blades	82 350
Bell Aircraft Corporation Buffalo N Y	War	Pursuit planes	19 896 068
Republic Aviation Corp Farmingdale Long Island N Y	War	Pursuit planes	56 499 024
Packard Motor Co Detroit Mich	War	Engines	62 448 000
Glenn L Martin Company Baltimore Md	War	Bombers	14 269 646
Boeing Airplane Company Stearman Aircraft Division Wichita Kansas	War	Training planes	6 934 096
Boeing Aircraft Company Seattle Washington	War	Bombers	54 762 850
Lockheed Aircraft Corp Burbank California	War	Pursuit planes	15 646 150
Colt's Patent Fire Arms Mfg Co Hartford Conn	War	Infantry weapons	2 796 056
Pullman Standard Car Mfg Co Hammond Ind	War	Infantry weapons	838 150
General Electric Co Erie Pa	War	Artillery	1 759 826
York Safe & Lock Co York Pa	War	Artillery	2 914 720
National Pneumatic Co Rahway N J	War	Artillery	5 763 753
Midvale Company Nicetown Pa	War	Artillery	1 260 408
Wheland Company Chattanooga Tenn	War	Artillery	1 500 000
Miller Printing Machine Co Pittsburgh Pa	War	Infantry weapons	503 727
Mesta Machine Co Pittsburgh Pa	War	Artillery	8 390 000
Continental Motors Corp Muskegon Mich	War	Engines	11 412 000
Guiberson Diesel Engine Co Chicago Ill	War	Engines	2 915 095
Wright Aeronautical Corporation Paterson N J	War	Airplane engines	6 829 144
Beech Aircraft Corp Wichita Kansas	War	Training planes	13 115 138
Harvey Metal Products Corp Chicago Ill	War	Ammunition components	145 800
Pennsylvania Forge Corp, Philadelphia Pa	War	Artillery	109 025
Acme Machinery Co Cleveland, Ohio	War	Forging machines	27 384
Crucible Steel Co of America Harrison N J	War	Artillery	102 885
Oil Well Supply Co Imperial Works Oil City Pa	War	Ammunition components	246 202
Delco Products Div of Gen Motors Corp Dayton, O	War	Ammunition components	110 114
Rheem Manufacturing Co Chicago Ill	War	Ammunition components	326 541
Mack Molding Co Inc Wayne N J	War	Ammunition components	121 371
Pratt & Whitney Div, Niles-Bement Pond Co Hartford, Conn	War	Rifling machines	102 150

Newly Created Defense Plant Corp. To Provide Machinery for Packard

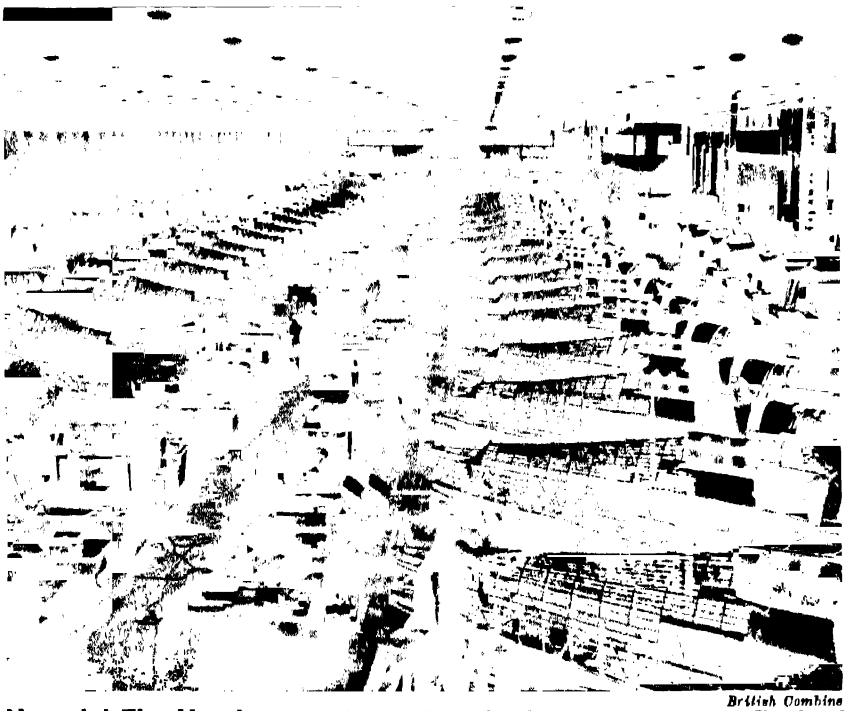
WASHINGTON—Providing machinery with which Packard can build Rolls Royce airplane engines is the first job assigned to RFC's Defense Plant Corp This corporation was formed to care for the case of defense plant which the Army or Navy doesn't want to own and where through fear of complications the manufacturer doesn't want to take an RFC loan In such a case the Defense Plant Corp will borrow money from RFC itself provide the needed machinery and rent it to the manufacturer Details on the Packard deal have not yet been made public but apparently the Defense Plant Corp came into the picture because of the complications of joint U S -British financing The arrangement at present is that Britain is providing two-thirds of the machinery the Defense Plant Corp one third, and Packard is using its own buildings exclusively

Training Planes For U. S., Pursuit Ships For England, Is Schedule

WASHINGTON — Commissioner Knudsen's statement that the British will get 40% of our aircraft output over the next 18 months is doubtless accurate but it can be somewhat misleading It fails to take into account the vital distinction between combat and training planes and doesn't say whether it is the first 40% or the last 40% that goes abroad Actually it is well understood in the aircraft industry that the general order of precedence is about as follows First, pursuit planes for Britain because the big job now is to chase away Heinkels, second training planes for the U S so that when we take delivery on fighting ships we'll have pilots to fly them, third, bombers for Britain for the still hoped for day when a major offensive can be undertaken against Hitler

The niggling attitude which has characterized British procurement ever since war's outbreak is finally beginning to be liberalized Contracts are now being signed containing no quantities but agreeing instead to take the full output of whatever portion of the plant's capacity is allocated to export by the defense commission However, only a few weeks ago at least one major manufacturer had an assembly line tooled up to produce 100 combat ships a month which had been standing idle for nearly three months while financial and technical details were worked out on the next order

The whole question of capacity allocation between export and domestic demand is, of course, vital to munitions manufacturers



British Combine

Hurryin' The Hurricanes—*Somewhere in the western part of England workers are busy building Hurricane fighter planes for the Royal Air Force. Production continues ceaselessly in an effort to attain mass proportions. Above is one of the shops where Hurricanes are produced*

Japanese Machine Tool Producers Compelled To Follow Government Dictates on Defense

TOKYO—The National General Mobilization Law, recently passed by the Diet, has been invoked to compel machine tool manufacturers to follow the government's lead and build those tools which are indicated to be essential for national defense. If this procedure should inflict losses on the manufacturers, compensation is provided. The tools specified in the regulation have been mostly imported from the U. S. and are now subject to the American export licensing order.

Importers have disclosed that the decreased shipments of machine tools and scrap steel from the U. S. have only mildly affected the Japanese industry. The real difficulty lies in Japan's own economic backyard. Japan's international balance of payments has failed to improve, and import permits are increasingly difficult to obtain. At present there is a growing backlog of applications awaiting authorization.

Imports of machine tools for the first half of 1940 were estimated at $18,565,000 as compared with $21,385,000 for the corresponding period of last year. If the depreciation of Japanese currency and the increasing cost of machine tools in the U. S. is considered, the true dimensions of the decline in Japanese imports become more apparent.

Since the outbreak of the European war the exports of machinery and machine tools have increased. Shipments during the first half of 1940 were valued at $52,875,000 as compared with $39,480,000 and $26,085,000 for the corresponding periods of 1939 and 1938.

Exports during the first six months of this year included 3,482 automobiles and chassis, 184 locomotives, 22 steamships, and 4,500 tons of metal-working machinery. Shipments of metal-working machinery recorded a decline from last year.

FAKE INSPECTORS AT PLANTS

PHILADELPHIA — Manufacturers doing business with the Army Quartermaster Depot are warned to be on their guard against unauthorized persons seeking to inspect their plants. Major Vere Painter, officer in charge of inspection, said that he had received information that certain unauthorized persons sought to enter factories engaged in the manufacture of commodities for the Army and for the "purpose of making an inspection for the Army Quartermaster Depot." There is no question but that the men were using fake credentials indicates Major Painter.

October Automobile Production May Surpass 450,000 Units

DETROIT—Now past the hurdle of production "bugs," major auto plants are reaching full stride in the race to meet consumer demand for 1941 models. Independents, too, have lifted the assembly rate, being joined by Nash and Willys. At the New York Auto Show, the latter will make first public announcement of the "Americar," new name for its revised line that will feature a larger body but continue the four-cylinder motor.

Official passenger and truck production in September will not be reported for several days, but the industry generally has swung into volume production so fast that earlier estimates must be revised upward to approximately 300,000 for the month. Thus, output surpassed that of Sept. 1939 by at least 56 per cent.

Cheered on by market possibilities and initial reception to new models, auto makers are scheduling near-capacity production for October. At this point output is estimated at between 450,000-475,000 units, with the top limit more likely. There is no reason to believe now that this fast pace cannot be maintained into December. Percentagewise, fragmentary sales reports for the first few weeks of September look favorable, but a better line on the strength of the retail market during fall months can be obtained only from sales reports.

Cadillac Invades The Medium Priced Field; Drops La Salle

DETROIT—Introduction of a new Series 61 at a base price of $1,345 and lowering the price of the Series 62 to $1,420 constitutes Cadillac's bid for a share of the growing market for medium-priced automobiles. Last year's "cheapest" Cadillac cost $1,685. Six lines are introduced for 1941, and all will be powered with an improved 150 hp. engine and be trimmed by Fleetwood. The LaSalle has been dropped. Present owners have been advised that complete parts and service facilities will be maintained.

Three of the six series are new—the 61, the 63 starting at $1,695 and the 67 starting at $2,595. The new 61 has the same wheelbase as the displaced LaSalle, 126 in., but its engine will develop 25 more horsepower, the body shell is new, and general treatment is in the Cadillac tradition. All Cadillac hoods have been revised to eliminate the hood side panel, the low broad hood now resting on fender "bridges". Front-end treatment is new and massive. Nickolas Dreystadt, Cadillac general manager, asserts that building of Allison parts has not and will not interfere with automobile production, because plenty of floor-space and workmen are available.

WATCHING WASHINGTON

"Bankable contract" is expected to cover most of the plant expansion. This method will bring in private capital and conserve RFC funds. $558,959,990 lent by RFC in three months

By BLAINE STUBBLEFIELD

WASHINGTON—A variety of procedures is being worked out to meet the several types of plant expansion necessitated by the defense program, and it becomes increasingly clear that no armament manufacturer is going to have to risk losing any of his capital—unless he is a natural gambler and deliberately chooses to take the risk.

The so-called "bankable contract" is growing in importance. Originally conceived simply as an intermediate step between private and government financing to meet certain special cases, it has now assumed a dominant position in defense commission thinking. Men in key defense jobs think nearly all defense plant expansion will take this form.

Basis of the plan is that, if the armament race lasts five years, the government is going to pay for privately financed plant expansion anyway because the price of the arms it buys will contain a plant item. The bankable contract is supposed to ensure that if the boom folds, the manufacturer won't have to take the loss—and if the boom lasts the manufacturer won't get a free plant with which to discomfit his competitors.

This is accomplished by separating an arms purchase transaction into two contracts. One specifies that the manufacturer will deliver over, say, the next two years, a specified quantity of goods at a price containing no item for the necessary plant. The second contract provides that the manufacturer will build a plant, and that the government will pay him the cost of the plant in five annual installments, the government assuming title when it has completed the payments. The manufacturer can then assign his rights under contract number two to a bank as security for a loan with the proceeds of which he will build the plant.

During the five years, the manufacturer in his tax statements enters the payments from the government as income and on the other side charges off an identical amount as plant depreciation under the authority in the new tax law.

At the end of the five years, the manufacturer may either leave title with the government or, if he prefers may buy the plant from the government at a price equal to the original cost less physical depreciation—figured at a rate agreed upon in the original contract. The rates to be used will vary with each contract but in general will be somewhat more liberal than are allowed by the Treasury for income tax purposes. Typically, an aircraft plant will be depreciated at 5 per cent a year as regards the building, 12 per cent as regards heavy machinery, and 50 per cent a year for portable machinery.

If the manufacturer does not buy the plant, the government will agree to tear down the plant.

As compared with a straight program of RFC loans, this scheme has the advantage of bringing in private capital, thus conserving the RFC's billion and a half, and should also—so gilt-edged is the security—result in substantially lower interest rates than the 4 per cent which RFC charges.

Though the bankable contract is expected to cover most expansion, two other methods are available. In one of several procedures, the government may build and own a plant, hiring a manufacturer to run it or renting it to a manufacturer. This is being used for products—such as smokeless powder—with no commercial market.

Alternatively, a manufacturer may finance his plant himself in a normal manner. If the defense boom lasts, he will profit, since in five years he will have a plant completely written off and belonging to him.

DEFENSE WORK PROGRESSES

WASHINGTON—Donald Nelson, coordinator of national defense purchases, in a recent radio address, summarized progress of the Defense Commission: More than half of the strategic and raw materials needed for the stockpile have been acquired. Contracts have been let for more than 200 warships. A system of vocational training for defense skills has been set up and it covers 100,000 students. Contracts are in the hands of manufacturer for more than 10,000 service airplanes, and builders are preparing to produce 15,000 additional craft. The Commission has cleared contracts, which have been awarded by Army and Navy, in excess of six billion dollars. It is the Commission's purpose to guard against needless sacrifices of peace-time advantages, and to avoid interference with normal democratic and desirable processes.

Tin — Vital For Defense

Tin is a vital element in the defense program, not because substitutes couldn't be used, but because a change from present practices with tin would seriously cut the speed of production. This is particularly true of tinned steel containers for food, fuels, oils, and other commodities. About half of U. S. tin consumption goes into "tin cans." To make cans at the necessary high speed, you have to have solder, which is half lead and half tin. Also vital are babbitt bearings, containing much tin, used through the whole gamut of machinery. Bronz bearings, too, are important. Defense Commission announced that the U. S. received 12,400 long tons of tin in August, and at month-end 22,364 l. t. were afloat to this country. Government agencies have purchased 13,694 l. t. for the stockpile. The U. S normally consumes 70,000 to 80,000 tons a year; this will increase rapidly.

RFC Loans

Loans totaling $558,959,990 to aid the national defense program were made by RFC from June 25 through September 18. Banks participated in 21 of the total 112 loans, to the extent of $531,491.

Four corporations created by RFC got loans as follows: Rubber Reserve Company, $145,000,000; Metals Reserve Company, (for tin and other metals) $105,000,000; Defense Supplies Corporation (for high-test gasoline) $58,250,000; Defense Plant Corporation (for plant expansion, equipment) $30,000,000.

Twelve loans totaling $188,112,855 went to manufacturers of planes and parts, mostly for expansion of plant; five loans totaling $10,042,500 went to makers of machine tools and precision instruments; incidentaly 46 loans were made to aviation schools operating under CAA pilot training program for 79 small planes.

Loans of special interest, outside of the RFC-created company loans: Consolidated Aircraft, $12,300,000; Bendix Aviation, $18,587,855; unnamed manufacturers of machine tools in Davenport, Iowa, $10,000,000; Grumman Aircraft, $3,500,000; Curtiss-Wright, $51,160,000; Wright Aeronautical, $92,000,000; Bantam car, $125,000; Reynolds Metals, $15,600,000; Boeing Aircraft, $10,500,000.

Canada Permits Plant Write-offs Before Profits Are Subject to Excess Profits Tax

MONTREAL — Since intensified war production has started in Canada industrial companies have had little opportunity to argue over the terms in war contracts. In some cases companies have been told to begin production and that payment would be made. Refusal meant government operation of the plant. However now that the first rush of orders is a reality the government is taking measures to assure fair treatment to industrial plant owners and stockholders. Companies which have made new capital outlays for the production of war materials have been invited to state their case to a War Contracts Depreciation board. The government is permitting companies to make depreciation write-offs before showing profits which are subject to income and excess profits taxes.

In addition a board of referees has been set up by the government to assure that no company or firm will suffer unduly from the excess profits tax which was increased in the last budget from 50 per cent to 75 per cent. Special provision was made for adjusting the standard of profits in the case of new and depressed business. The new referee board will set the standard of "normal" profits on the basis of the four-year period before the war. The board will decide which firms are in the category of depressed industries, and therefore not to be taxed on profits increases like other industries.

New Plants Cost $225,000,000

More than 100 new plants and plant expansions costing approximately $225,000,000 have been contracted for on the part of the British and Canadian governments since the war started. About 35 per cent of the total has been financed by the Canadian government. Orders for war supplies which have been placed, or are about to be placed, by Canada's Munitions & Supply department now total $345,000,000. This amount is divided among 4,400 Canadian firms and the materials ordered include everything needed to equip, maintain, and feed men in the army, naval and air forces. In addition the British government has placed orders for $208,000,000.

Meanwhile in Ontario the first of the big explosives plants being erected by the British government already has started production, 2½ months ahead of schedule. The plant, which employs 3,000 men, has already begun shipments to Britain. Two additional explosives plants, one in Quebec costing $19,600,000 and a $9,000,000 plant in Manitoba, are well underway. Both will be in production next year, as will most of the new government war plants.

In the Montreal area an $8,000,000 English-type shell-filling plant will be in production by November. An American-type shell-filling plant, being built in Ontario at a cost of $8,000,000, will be producing by the middle of next year. In conformance with the new government policy of modeling military production after American products, the latest plants are all of the American type. Further, as many plants as possible are being built in central Canada due to the relative safety of this area from attack.

Gun Production Increased

A $2,500,000 capital investment has been made recently in a rifle factory. $13,000,000 was spent on a 3.7 anti-tank gun plant, and $10,000,000 on a plant to make 25-pounders. $11,000,000 was expended for facilities for making 40-metre guns which also can be used for anti-aircraft purposes.

Sorel Industries Ltd., originally a $5,000,000 plant erected to produce 25-pounders, has been taken over by the government. The plant, which is now a $10,000,000 project, has added facilities for the manufacture of naval guns.

The government is spending $1,000,000 on a plant to make aerial bombs. Canadians are also making Bren guns, Colt-Browning and submachine guns, rifles, torpedoes, and depth bombs. While plants were being built coastal guns were imported from Britain and 18,000 Lee-Enfield rifles were purchased from the U. S. The Government is also spending $62,000,000 at various shipyards.

The following contracts have recently been let by the government: Aircraft, Canadian Vickers Ltd., Montreal, $45,259.20; Canadian Wright Ltd., Montreal, $11,904.41; DeHavilland Aircraft of Canada Ltd., West Toronto, Ont., $8,094.75. Machinery, J. Bertram & Sons Co., Ltd., Montreal, $7,534; Williams and Wilson Ltd., Montreal, $16,650; and Greenlee Tool Co., Rockford, Ill., $10,864; Dominion Hoist and Shovel Co., Ltd., Montreal, $18,144; and Stephens-Adamson Mfg. of Canada Ltd., Belleville, Ont., $285,991.

Shipbuilding, Chantier Maritime de St. Laurent, Ltd., St. Laurent, Que., $28,500; Munitions, British Admiralty, $444,000; Frost and Wood Co., Ltd., Smith Falls, Ont., $28,350; International Metals Industries Ltd., Toronto, $80,050; Rogers Majestic Corp. Ltd., Toronto, $50,193; Federal Laboratories, Inc., Pittsburgh, $346,342; and U. S. Ordinance Engineers Inc., Cleveland, $508,793.

OLDSMOBILE GETS SHELL ORDER

DETROIT—Oldsmobile Division of General Motors has been awarded an order by the Ordnance Department for 9,505,600 shells, delivery to begin in eight months. This order comes on top of Oldsmobile's acquisition of a new press plant and forge shop facilities containing 150,000 sq. ft. of space. New machinery will be necessary, but will be the property of the corporation rather than of the government. This shell contract probably will be followed by orders for other munitions in lesser amounts to other G.M. divisions.

$20,000,000 Airplane Order Is The Biggest In U. S. History

WASHINGTON—Biggest airplane order ever placed in the U. S. went from Army to Douglas for $20,000,000 of transports (about the same as DC-3). The Douglas backlog is up to $400,000,000. Robert Hinckley, boss of CAA training of 45,000 pilots, answering charges that his project is a "boondoggle," says Germany did it, and it wasn't a boondoggle. The United States is a jump ahead of Europe with Navy's new powered gun turret on the Martin patrol flying boats, just starting delivery. Engineers in high places tell us the rotary wing plane will not be worked out till after the present excitement. Big planes, like Martin and Douglas 70-tonners, can carry so much armor and such big guns that present fighters cannot approach them. Big Shots admitted to Washington's back rooms come out saying the United States will pull its guns on Japan before tackling Germany, that the Nippons will back down in face of the American Navy.

CIO Pledges Support to Workers Who Strike in Defense Industry

NEW YORK—The Greater New York Industrial Council, C.I.O., pledged support to employees of the Ford Instrument Co. who have gone out on strike. The company is making bomb sights for the Navy in its plant at Long Island City.

The whole question of the right to strike in defense industries is involved. The employees of the Ford Instrument Co., which is a subsidiary of the Sperry Gyroscope Co., are members of the United Electrical, Radio and Machine Workers.

Representatives of the Union plan to see Sidney Hillman, Defense Commission's labor co-ordinator, in an effort to come to a settlement. Observers indicate that to allow strikes will slow defense preparations.

INSIDE DETROIT

Auto companies work on 1942 models, but keep one eye on Europe; promise to be spearhead of U. S. defense operations. Lack of supervisors feared when employment reaches high peak

BY RUPERT LE GRAND, DETROIT EDITOR

DETROIT—As they always do at this time of year, styling and design sections of automobile companies, particularly of General Motors, are working feverishly on models to be offered a year hence. On the surface, that would indicate that car makers feel pretty good about being able to retool for refurnished 1942 models. Actually, they aren't so optimistic. They intend to have all the plans ready on the shelf in case Herr Hitler has subdued everybody in sight or in case the world is made safe for democracy by next spring. Since neither event appears probable, it is likely that 1942 plans will accumulate many cobwebs, and the industry will have to content itself with a few sheet metal changes (and possibly none at all) and call it a day.

Perhaps it is wishful thinking, but local tool and die interests point out that relatively few dies will be needed for the defense program, hence die makers will not be in heavy demand. This is the slack season for tool and die makers around Detroit, and executives have their fingers crossed hoping that these men will not be lured elsewhere by boom-time conditions. Already this year many tool and die makers, because of high rates and overtime, have earned what in normal days would be considered a comfortable year's income. Even so, there is no assurance that they may not be tempted to make a killing while they can. After all, die makers can be used on other work at high rates. One big automobile company thinks it can hold its tool and die makers by continuing to put them on production work when they are not busy on tools and dies. That plan guarantees them a steady income the year round.

Supervisory Help Needed

Automotive executives, looking ahead, are not worrying half so much about a shortage of skilled and semi-skilled men as they are of supervisory help, especially foremen. The depression years washed out many good foremen who have drifted away and no longer are available. Moreover, unionization of the industry put foremen in a tight spot. For the small financial gains, they sacrificed a good deal by being cast out permanently from the workers' ranks, even in bad times. The solution seems to lie in devising ways and means of training new foremen in a hurry and in making it worthwhile for a man to become a foreman. It wasn't so long ago that some foremen were on hourly rates like the men under them.

Unless the world unexpectedly becomes peacelike, Detroit promises to be the spearhead of defense operations six to ten months from now. Detroiters are talking in terms of the highest employment peak in history. Officials are convinced that another silk shirt era is about to be born and are preparing for it. They talk big about aircraft engines, tanks and machine guns being built without interfering with automobile production, but get them off in a corner and they'll confess some doubts. Even with the outlook bullish, they are more cautious in their planning than releases from publicity offices would indicate. One high official is on record as saying that his corporation doesn't intend to accumulate huge inventories of parts, sub-assemblies or finished cars should it appear that it may be hard to get steel or other materials. The management is in a mood to play safe no matter what develops.

The perennial controversies about rates of production and speed-ups between management and union labor at the beginning of a new model season have occurred. Both Chrysler and Fisher Body are reported to have suffered from "sloppy work" strikes which are annoying and costly. The method of meeting the situation has been to close down the plants for the day as soon as workers start such tactics. As the industry swings into volume production, it is believed that these work interruptions will disappear. Incidentally, the feeling is that General Motors this season will not permit itself to be pushed around by the CIO-UAW the way it has been on some occasions.

Ponder Munitions Contracts

The type of munitions contract to be negotiated with auto and parts makers will depend upon the circumstances surrounding each case. Mr. Knudsen has said that plants with no commercial value after completion of the national defense program will be

NO STUDEBAKER AIRCRAFT

DETROIT — Repeated rumors that Studebaker will make aircraft parts for Curtiss-Wright were declared to be without foundation by an executive of the former company. Studebaker has given consideration to a number of projects connected with the national-defense program, but none has been awarded. Whether the South Bend plant will be expanded if defense projects are undertaken depends largely upon the nature of the product.



Giant Engraver—*Entirely automatic is the above engraving machine. It is shown in an operation as it carves a roof die from nickel steel for the 1941 Ford sedan. A "feeler" working along the edge of a model guides the cutting tool as it whittles away at a slab of steel*

U. S. Government Contracts Awarded to Tool Makers

(Defense contracts on page 774c)

Contractor	Gov't Agency	Commodity	Amount
Lodge & Shipley Machine Tool Company, Cincinnati, Ohio	Navy	Lathes	$119,756
Kearney & Trecker Corp., Milwaukee, Wis.	Navy	Milling machines	59,763
Axelson Mfg. Co., Los Angeles, Cal.		Lathes	61,459
South Bend Lathe Works, South Bend, Ind.	NYA	Lathes	37,800
International Harvester Co., Chicago, Ill.	War	Tractors	2,272,500
Allis Chalmers Mfg. Co., Milwaukee, Wisc.	War	Tractors	1,196,409
National Twist Drill & Tool Co., Detroit, Mich.	Navy	Twist drills	18,333
William Sellers & Co., Inc., Philadelphia, Pa.	Navy	Planer	32,405
Warner & Swasey Co., Cleveland, Ohio	Navy	Turret lathes	10,274
National Acme Co., Cleveland, Ohio	War	Spindle machines	35,272
E. L. Essley Machine Co., Chicago, Ill.	War	Honing machine	30,348
R. K. LeBlond Machine Tool Co., Cincinnati, Ohio	War	Boring lathes	108,911
Tidewater Supply Co., Inc., Norfolk, Va.	Navy	Turret lathes	17,071
Cincinnati Milling Machine & Cincinnati Grinders Inc., Cincinnati, Ohio	Navy	Milling machines	109,735
Gisholt Machine Co., Madison, Wisc.	Navy	Turret lathes	40,297
Reed-Prentice Corp., Worcester, Mass.	Navy	Lathes	111,670
Brown & Sharpe Mfg. Co., Providence, R. I.	War	Screw machines	89,115
The Hanson-Whitney Machine Co., Hartford, Conn.	War	Milling machines	12,561
The LaPointe Machine Tool Co., Hudson, Mass.	War	Broaching machines	12,672
Niles-Bement-Pond Co., Pratt & Whitney Div., Hartford, Conn.	War	Milling machines	31,488
Cincinnati Milling Machine & Cincinnati Grinders Inc., Cincinnati, Ohio	War	Milling machines	171,856
Brown & Sharpe Mfg. Co., Providence, R. I.	War	Milling machines	85,200
Heald Machine Co., Worcester, Mass.	War	Boring machines	11,641
Austin-Hastings Co., Inc., Cambridge, Mass.	War	Drill presses	74,091
Kingsbury Machine Tool Corp., Keene, N. H.	War	Drilling machine	11,557
Swind Machinery Co., Philadelphia, Pa.	War	Lathes	13,080
Henry Prentiss Co., New York, N. Y.	War	Grinding machines	14,196
Wilson-Brown Inc., New York, N. Y.	War	Honing machines	33,832
William Sellers & Co., Inc., Philadelphia, Pa.	Navy	Planers	156,220
Niles Tool Works Division General Machinery Corp., Hamilton, O.	War	Turning lathes	172,500
The Bullard Co., Bridgeport, Conn.	Navy	Lathes	64,956
Wm. Sellers & Co., Inc., Philadelphia, Pa.	Navy	Machines, boring, drilling and milling	95,248

financed by the government and title will remain with it, although the plant may be operated upon a management-fee basis. The Chrysler tank plant is an example. Plants now having equipment, which can be used or expanded, may be financed by private or RFC funds, and after orders are filled negotiations will be instituted with the manufacturer to take over the facilities upon the basis of fair value, subject to approval by the Secretary of War or Navy. The Commission has also worked out a "plant facilities" contract, which is separate from the parts contract, and which guarantees the manufacturer the cost of plant additions or new plant over a five year period, but protects the government's equity.

G.M. Has Machine-Gun Contract

General Motors' machine-gun contract provides that the equipment necessary to the program shall be paid for and remain the property of the government, while the corporation will build and own any new structures involved, either to house gun manufacture or displaced domestic products. Machine gun manufacture will be set up as special departments at the Saginaw Steering Gear Div., Saginaw, Mich., AC Spark Plug Division at Flint, Frigidaire Division at Dayton, and the Guide Lamp Division at Syracuse. The regular division managers and operating personnel will be in charge, but the government work will not impair production of domestic goods, will not be intermingled therewith.

The contract provides $20,000,000 for equipment, some of which is already on order, and $61,319,882 for the machine guns. It is estimated that approximately 70,000 guns are involved, with Saginaw, AC and Frigidaire sharing about equally and Guide Lamp having a lesser amount. Guns for several purposes are covered in the contract; also two calibers, 30 and 50. The number of guns involved is large, but considering the requirements of the projected field forces, plus aviation, it is apparent that these facilities must be increased.

The new building program will be completed this winter, according to present plans, and gun manufacture will commence within a year to fifteen months. Production studies preparatory to manufacture of machine guns have been going on for more than two years at General Motors in cooperation with the War Department. It appears that operations will be well tooled but that specialized high-production machinery is not needed, even if obtainable.

Milling Presents Problem

One of the chief problems in machine gun manufacture is the heavy proportion of milling operations. Some of these operations will be set up for continuous production, others will require the use of interchangeable fixtures. Drilling, tapping and reaming operations may be combined upon a multi-head machine, but sliding fixtures will be chosen instead of attempting high-production setups with indexing tables. Threads may be milled on automatic equipment.

Frigidaire has announced that machine gun manufacture will be carried out in additional facilities, including a new five-story building. AC will devote existing space to the gun contract, re-align domestic operations without impairing production, and eventually erect new structures for its own use. Saginaw Steering Gear will erect new buildings for gun operations, but probably at some distance from present facilities. It is unlikely that any of these new buildings will be of windowless construction similar to the Allison plant and the Ford airplane plant now under construction. Guide Lamp has space available.

Ford's Plant Air-Conditioned

When completed, Ford's new airplane plant will be in marked structural contrast to the adjacent Tool & Die Plant and other nearby buildings. The other structures (only two years old) are mainly glass, while the airplane plant will be of windowless construction. Further the Ford plant is designed to provide an interior free of wide temperature changes and capable of being air-conditioned so that the most comfortable working conditions are attained for precision manufacture. There is no truth in rumors that the Ford airplane plant is the first building to be erected in this country for complete blackout.

The airplane plant will measure 360x1,000 ft. The main section will comprise two stories approximately 950 ft. long, while an end section will be three stories. Second floor of the manufacturing section will be devoted to machining operations, first floor to assembly. The end section will include an aircraft training school and dining rooms. A new construction idea involves use of the lower flange of the second-floor girders for mounting low-headroom cranes.

NLRB OUTLAWS BLACKLISTING

WASHINGTON — Maintenance by an employer of a blacklist of people he doesn't want to hire because of their union affiliations will be pretty dangerous if the courts uphold the NLRB decision in the case of Nevada Consolidated Copper. The board ordered the company to "reinstate" with back pay four men who did not apply for work when the mine resumed operation. The board decided that the men did not apply because they had reason to believe they would be refused and that their names were on a blacklist so that if they had applied they would have been refused. Circuit court has already upheld a board decision that an employer may not refuse to hire a man because of his union membership.

Colwell and Beechcroft Get S.A.E. Nominations for 1941-42

NEW YORK—A. T. Colwell, vice president of Thompson Products, Inc., and David Beechcroft of Bendix Products Division, Bendix Aviation Corp., have been nominated for 1941 President and Treasurer, respectively, of the Society of Automotive Engineers.

For the term of 1941–42 the following have been nominated for membership on the SAE council: N. C. Millman, General Motors of Canada, Ltd., H. O. Mathews, Public Utility Engineering & Service Corp., and D. A. Fales, Massachusetts Institute of Technology.

Nominated for vice presidents are: Mac Short, Vega Airplane Co., Dr. George W. Lewis, National Advisory Committee for Aeronautics, L. C. Lichty, Yale University, J. B. Macauley, Jr., Bendix Aviation Corp., J R. Hughes, Studebaker Corp., E. S. Chapman, Chrysler Corp., Chauncey W. Smith, University of Nebraska, T. L. Preble, Tide Water Associated Oil Co., and R. S. Reed, Brockway Motor Co., Inc.

Association of Manufacturers Takes Defense Plant Inventory

NEW YORK—The management of industry in this country has already "volunteered" and that business rather than government effort is putting the most drive into the national defense, declared H. W. Prentis, Jr., president of the National Association of Manufacturers. The association, its Industrial Council and 243 affiliated organizations, is conducting its own "nationwide" inventory to reveal all unknown defense potentialities of small and large plants. This move is designed to supplement the stock-takings of the procurement divisions of the Army and Navy for mobilization day. It is one of the major points in the N.A.M. program to effect complete co-operation of industry in the preparedness drive.

Other phases are: An economic study of war financing, war price and war labor control, in the light of British, French and German experience, and an industrial research survey, designed to stimulate an increase in the percentage of corporate income spent for encouraging national inventive genius in developing military, naval and air strength.

The association's survey on war financing, price and labor controls will be completed soon and forwarded to the national administration in Washington. The research was instituted by Dr. Karl Compton, president of the Massachusetts Institute of Technology and chairman of the association's advisory committee on scientific research.

Elected President



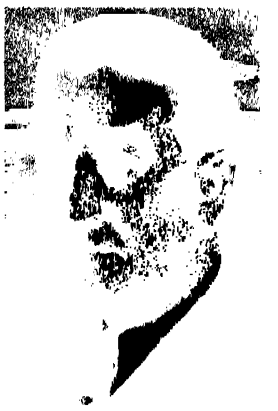
GEORGE J. ZIMMERMAN

Becomes President



EARL D. POWERS

New Chairman



B. L. WATERS

NAMES in the NEWS

George J. Zimmerman, formerly vice president and general sales manager of Strong, Carlisle & Hammond Co., was elected president of the company. Mr. Zimmerman, who has been actively associated with the company for 39 years, began as an office boy. In 1905 he was advanced to the machinery department where he served as sales manager to 1937. At this time he was elected vice president and general sales manager. He has been a director of the company for 20 years and he is also a director of the Hammond Manufacturing Co. and Clark Manufacturing Co. of Cleveland, both of which are subsidiaries of the parent company.

William W. Finlay was appointed manager of the new manufacturing division of Wright Aeronautical Corp. which will be established at Lockland, Ohio, near Cincinnati. He has been affiliated with the corporation for the past 13 years and for the past two years Mr. Finlay has been engaged in special assignments for the general manager in addition to directing the activities of the license division. In 1927 he entered the organization as time-study-engineer, rising rapidly to manager of the production division.

S. C. DuTot was promoted to the post of general manager in the Birmingham, Pittsburgh, Cleveland and Detroit areas of the Electro Metallurgical Sales Corp. W. E. Remmers was appointed division manager of the Chicago Corp. and R. E. Brown was named division manager of the Pacific coast.

F W. Werner has been appointed assistant to the president in charge of coke by-product sales of all subsidiary companies of the United States Steel Corp. of Delaware. Mr. Werner has been in the employ of the Corporation since 1907, and was appointed assistant to vice-president in charge of sales in 1938. He has held this position until his recent appointment.

B. L. Waters, former president, has been elected chairman of the board of Lyon Metal Products, Inc. Earl D. Powers, formerly vice-president and general manager, has been elected president of the company Mr. Waters succeeds H. L. Gardner, general counsel of the company, who resigned.

George H. Johnson succeeds his father, Hobart S. Johnson as president of Gisholt Machine Co. He represents the third consecutive generation of the Johnson family to hold this position, as the company was founded by his Grandfather, John A. Johnson, in 1889. Hobart S. Johnson was named chairman of the board, and H. S. Johnson, Jr. was elected a vice-president.

John P. Major, traffic manager for the Worthington Pump & Machinery Corp. in Buffalo, has completed 50 years of service with the company.

M. J. McKeever was appointed manager of Crucible Steel Company's Atlanta branch. He has been an employee of the company for 15 years.

P. J. Christy has been appointed manager of the Philadelphia, Pa. office of Chicago Pneumatic Tool Co. He succeeds A. M. Brown, who has been transferred to Washington, D. C. as the manager of the branch recently opened there.

Frank W. Robertson has been named general manager of the Edward W. Voss Machinery Mfg. organization.

Chief Engineer



JOHN W. HARSCH

Engineering Director



W. RICHISON SCHOFIELD

W. Richison Schofield, formerly chief engineer of Leeds & Northrup Co., has recently been appointed director of engineering. John W. Harsch, assistant chief engineer, has been advanced to chief engineer, and Mr. Harsch's former position has been filled by the promotion of John F. Quereau. Mr. Schofield, an authority in pyrometry and automatic control, joined the company in 1916, and since 1928 has held the position of chief engineer. Mr. Harsch joined the organization in 1924 and in 1928 became assistant chief engineer. Mr. Quereau has been associated with the company since 1929.

Charles Koch, Edward Koch, Sr, and Edward Koch, Jr., three generations of the same family, are all employed as machinists by the General Electric Co. Charles Koch, who operates a boring mill, has been associated with the company for 48 years. His son, Edward, Sr., who is also a boring mill operator, has had 22 years of experience with the company; while Edward Jr., has just finished the first year of his four-year apprenticeship.



Three Generations—*Of the same family are Charles Koch, Edward Koch Sr. and Edward Koch Jr. All are boring mill operators*

J. H. Marks, purchasing manager of Packard Motor Co. since 1925, was elevated to the position of vice president in charge of procurement, machinery and accessories in connection with the Rolls Royce engine project. In addition Marks will supervise the erection of new buildings and other details growing out of the expanding war plane contract. He has been associated with the organization since 1916 when he joined the company as superintendent of construction.

Ernest L. Mawhinney, Personnel director of the Jessop Steel Co., was recently appointed safety director of the company.

R. L. Hibbard has been named to the Detroit merchandising sales staff of Cutler-Hammer, Inc. He has been a member of the organization since 1936 when he began as a member of the company's student training corps.

BUSINESS ITEMS

The Whiting Corp., Harvey, Ill., has purchased the Quickwork Co., formerly of Ohio and Chicago, Ill., and manufacturers of rotary shears, stamping trimmers and forming machines, power hammers, and flangers. The entire Quickwork line will be manufactured by the Whiting Corp. at Harvey. Stevens H. Hammond, vice-president of the Whiting Corp., will be in charge of all Quickwork operations.

Rein & Webster, Inc., manufacturers' representatives, began operation this month at Cleveland, Ohio. The company will carry a full line of die castings, plastics, stampings and screw machine products. Frank H. Webster, formerly director of purchases for the White Motor Co., is president.

Four units of the former Willys-Overland plant have been acquired by the Boyce-Crane Company.

PLANT EXPANSION

Spencer Lens Co. is building a $1,250,000 addition to its present plant.

The Buffalo Foundry & Machine Co. is building a $24,000 addition to its plant, and will purchase $40,000 worth of new machinery.

Armstrong-Blum Mfg. Co., manufacturers of hack and band sawing machines, have started construction of an addition to their plant that will increase their floor space nearly 100 per cent.

The Hanson-Van Winkle-Munning Co., Matawan, N. J., manufacturers of electro-plating equipment and supplies, are expanding plant facilities due to increased demands.

MEETINGS

Society of Automotive Engineers. Annual dinner. Hotel Commodore, New York, N. Y., Oct. 14.

American Gas Association. Annual Convention. Atlantic City, N. J. Week of Oct. 7.

National Metal Exposition, Cleveland, Ohio Cleveland Public Auditorium Oct. 21-25.

National Safety Congress and Exposition Stevens Hotel, Chicago, Ill Oct. 7-11.

Society of Automotive Engineers. National Aircraft Production Meeting. Hotel Biltmore, Los Angeles, Calif. Oct. 31-Nov. 2.

American Society for Metals. Annual convention Hotel Statler, Cleveland, Ohio. Oct. 21-25.

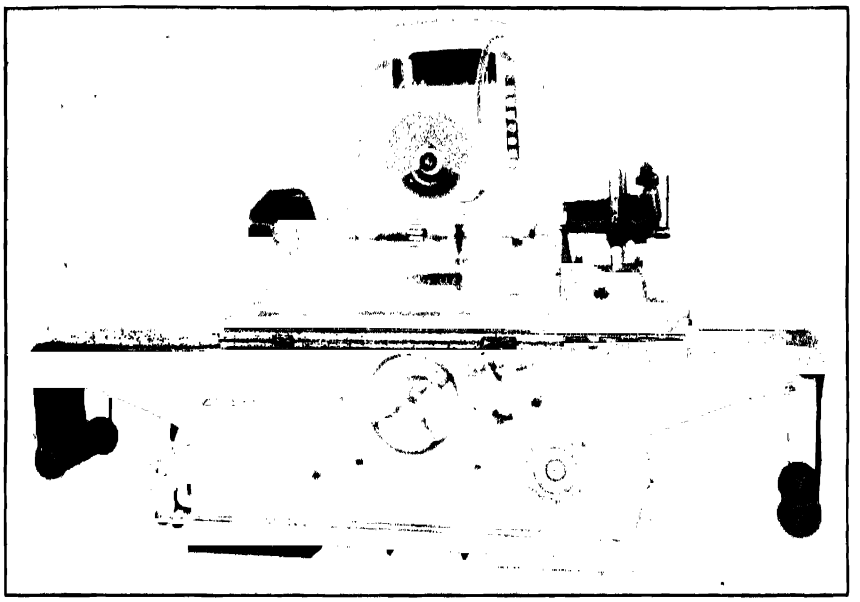
American Welding Society Annual convention. Hotel Cleveland, Cleveland, Ohio. Oct. 20-25.

The Wire Association. Annual convention. Carter Hotel, Cleveland, Ohio. Oct. 17-23.

American Society of Tool Engineers. Semi-annual convention. Cincinnati, Ohio. Oct. 17-19.

American Gear Manufacturers Association. The 23rd semi-annual convention, Skytop Lodge, Skytop, Pa. October 14, 15 and 16, 1940.

SHOP EQUIPMENT NEWS



Precision Gear and Broach Grinder Developed by National Broach & Machine

Increased production of quality gears with particular emphasis on accuracy is claimed for the "Red Ring" gear grinding machine, which was developed originally to meet the demand for precision grinding of master gears and involute broaches by National Broach & Machine Co., 11457 Shoemaker St., Detroit, Mich

Utilizing a U-column, the machine is exceptionally rigid, with wheel spindle mounted on long bearings. Spindle is integral with motor rotor, and spindle slide is adjustable vertically by a handwheel. Hydraulic counterbalance removes backlash from the lead screw

Table slide is hydraulically reciprocated and automatically controlled through a feed box on the front of the machine. Table speed is controlled accurately. Combination flat and V ways are covered at all times by a canvas roll and are provided with automatic force-feed lubrication.

Index head is furnished with either fully automatic or semi-automatic control, with the semi-automatic providing somewhat greater accuracy. Both coolant and hydraulic pumps are located on the outside of the machine. Reservoirs are inside the base.

For gear tooth work a templet control trimmer is provided which trims both sides of the wheel simultaneously. The table feed box includes a dead stop which brings the wheel to trimming position so that the diamond points operate exactly on the center line. Radius trimmer is mounted in the tail stock. Diamond points are vertically adjustable and may be set with a micrometer.

"Senior" Hydraulic Presses Announced by Colonial Broach

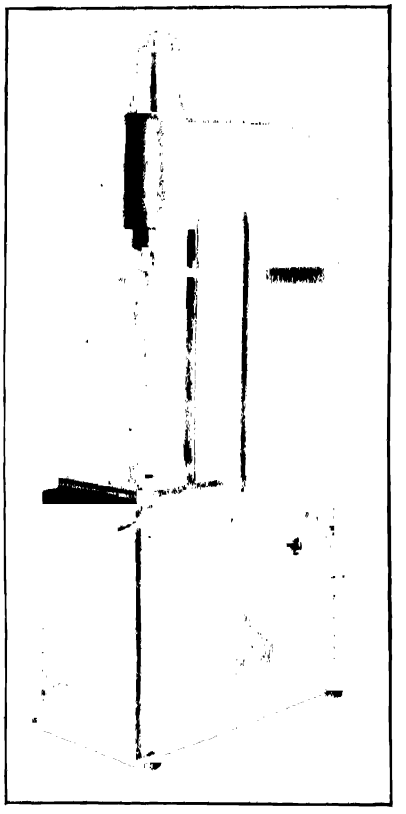
A line of general purpose hydraulic presses for such operations as assembling, broaching, etc., has been developed by Colonial Broach Co, 147 Jos. Campau St., Detroit, Mich. Designated as the "Senior" line, these presses range in capacity from 1 to 10 tons, with strokes ranging from 18 to 42 in.

Designed for maximum flexibility, they have motors located in the columns, requiring minimum floor space. Open side fixed table construction permits working on long parts which would extend beyond the machine table. Exceptional daylight allows for large fixtures, without sacrificing stroke. Work platen is removable for machining special clearance holes.

Rugged reinforced construction is used for frames. Cylinder bearings are in frame necks, eliminating unsightly protrusions. Cylinder is a leak-proof steel tube for maximum efficiency. Standard hydraulic pumps and equipment are used for economical replacement. Pumps are of large capacity, direct motor-driven. Located within the oil tank, the pump has exceptionally short suction.

Large coolant flow where required, as for broaching, is provided by an oversize centrifugal pump driven by a separate motor. Chips may be removed while machine is in operation.

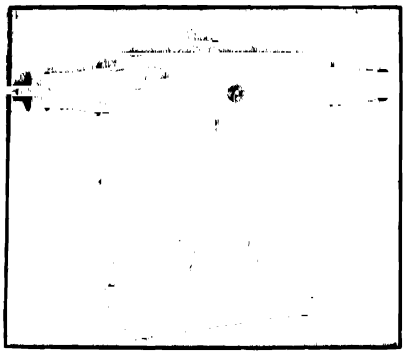
"Senior" presses can be furnished with controls to stop operation at top or bottom of piston stroke, or with an automatic return after the piston has completed its downward travel. A special hydraulic circuit is available which permits the use of shuttle type fixtures if desired, to speed up unloading and loading, while assuring



maximum safety to the operator. Presses are available in seven sizes: 1-ton, 18-in. stroke; 3-ton, 18- or 24-in. stroke; 6-ton, 24- or 36-in. stroke; and 10-ton, with 30- or 42-in. stroke. Floor space of the 1-ton model is only 18½x30½ in., with 29x51-in. for the largest model.

"Standard" Polishing Lathe Has Infinitely Variable Speed

Standard Electrical Tool Co., 1940 W. 8th St., Cincinnati, Ohio, has developed an infinitely variable speed buffing and polishing machine which pro-



vides correct speed for each operation, using any size or type of wheel Longer wheel life and more efficient production are also claimed, with an additional saving reflected in that worn wheels need not be discarded

Speed changes are accomplished merely by turning a handwheel Each change of spindle speed is shown in r p m on the indicating dial Full speed range is 1,000 to 3,500 r p m.

All equipment, including speed changer, constant-speed 1,800 r p m ball bearing motor and magnetic starter, is inclosed inside the base, while the pushbutton station is located at the front Removable louvered covers at sides and front and a large removable cover at top front provide easy access to inside of base

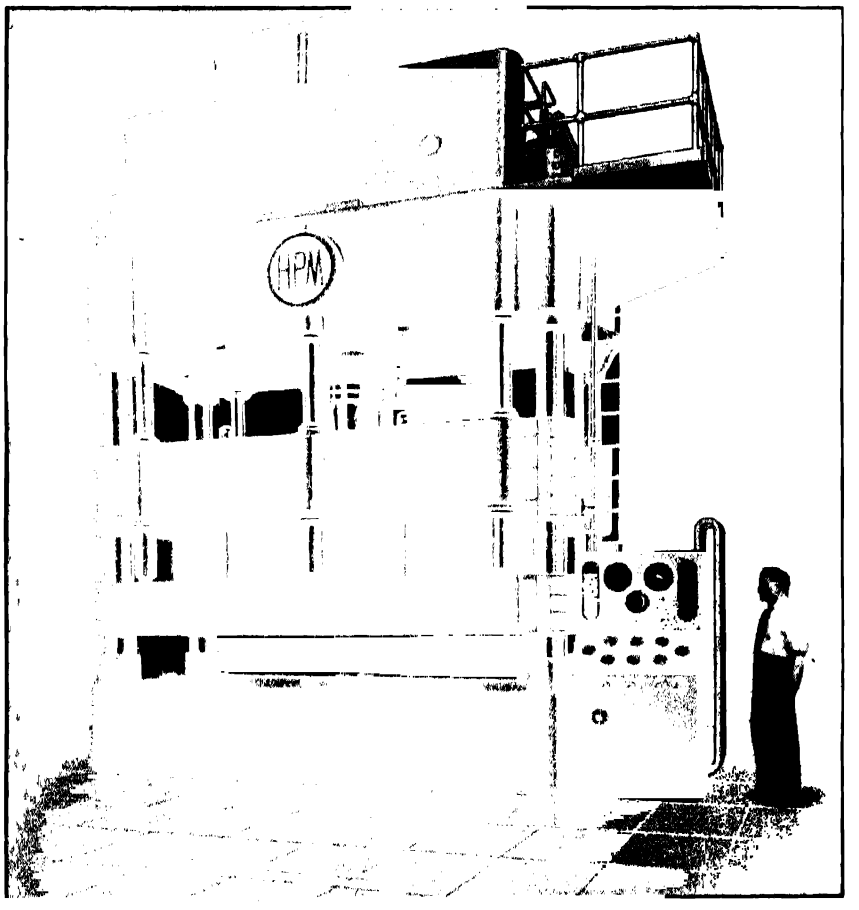
Available in 3, 5 and 7½ hp sizes, with larger sizes furnished to order, this machine is said to incorporate simple construction and easy operation, with quiet and smooth performance Straight front pedestal permits wheels to extend beyond the machine proper, allowing ample freedom of operation and foot room

650-Ton Triple-Action Blankholder Press Designed for Aircraft Parts Production

A recent development of Hydraulic Press Mfg Co, 20 E Broad St, Columbus, Ohio, is a 650-ton triple-action blankholder press designed especially for deep drawing gasoline tanks and other similar parts for the aircraft industry This press embodies three separate hydraulic actions for operating the main draw punch, the blankholder ring and the die bottom of the regulation triple-action drawing die Draw punch is carried by the main slide actuated by the main hydraulic press ram of a double acting piston type

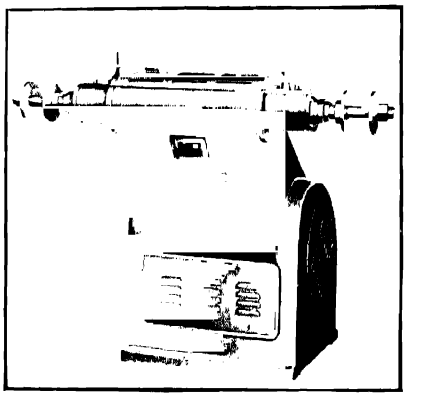
Among the exclusive features of this "H-P-M Fastraverse" press are accurate alignment of blankholder die ring rigidly supported by blankholder platen directly above, individual pressure adjustment of each blankholder ram, permitting variation of blankholder pressure at six separate points; all three hydraulic actions functioning from only one "Hydro-Power" piston type radial pump direct connected by one flexible coupling to one electric motor; and a closed circuit operating system providing smooth action with valveless and shockless press reversal

Pressures are 650 tons on the main platen, 250 tons on the blankholder, and 133 tons on the die cushion. Pressing surfaces are 144x72, 144x72 and 59x35 in respectively. Closing speed is 260, pressing speed is 45 and opening speed is 260 in per min. Power is furnished by a 100-hp motor.



Hammond Polishing Lathe Has Overhanging Spindle

An addition to the "Rite-Speed" line of polishing and buffing lathes offered by Hammond Machinery Builders 1618 Douglas Ave, Kalamazoo, Mich, is the Model No 10-ROH which features an overhanging spindle protruding 12½ in over the lower front of the base This feature makes the lathe



particularly suitable for work on large, bulky pieces

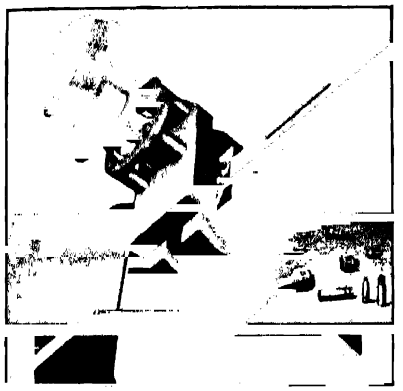
Standard equipment includes lock for holding spindle when changing wheels, a combination switch and brake which shuts off the motor and stops the spindle, automatic motor starter, and a 10-hp motor with multiple V-belt drive mounted inside the base of the machine

"Hoffman" Production Marker Operates at High Speed

Identified as the "Hoffman" production marker, a marking machine built by Quality Die Co, 9311 Baltimore Ave, Chicago, Ill, has been designed for high-speed marking of light or heavy formed metal parts, for rolling in metal identifying trade names, and for other identification A production speed as high as 7,000 pieces per hour is possible without jamming, in marking such products as shells, carburetor jets, venturi tubes, spark-plug bodies, and other round tubular or solid parts.

Machine is driven by a gearmotor,

without chains, belts or pulleys. Driving mechanism is fully inclosed, with sealed bearings used throughout. Gears are greased through Alemite fittings. Specially made marking die can have any number of lines and can



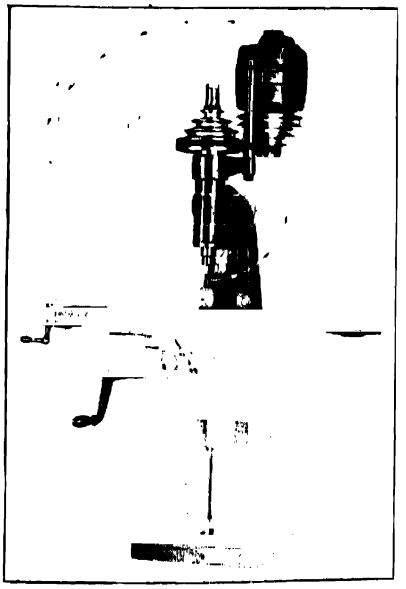
embody insert types to permit changing numbers.

Actual operation of the machine is automatic. Hand-feeding of parts to the gravity-feed chute is the only hand operation required

"Univertical" Milling Machine Designed for Smaller Jobs

The "Univertical" high-speed end milling machine has been developed by J D. Duffy & Son, 544 Insurance Exchange Building, Detroit, Mich , especially for small jobs and for those simpler operations which normally must be done on machines costing five times as much. Equipped with a swivel head graduated 90 deg. on both sides of the perpendicular, this compact machine mills, drills and bores. It can also be adapted to small grinding operations.

A bench type machine with a base 11x17 in., it is powered by a heavy-duty ¼-hp. motor, driving through a four-speed V-belt pulley, permitting



a range of from 850 to 3,400 r.p.m. Over-all height is 37 in. Table maximum lift to the end of the spindle is 10 in. with a work clearance of 6½ in. from the center of the spindle to the supporting column. Table, 24x4⅞ in. with T slots, has a cross travel of 17 in with a forward and back travel of 7 in. All table movements are graduated to 0.001 in.

Ball Joint Machine Vise Locked at Any Angle

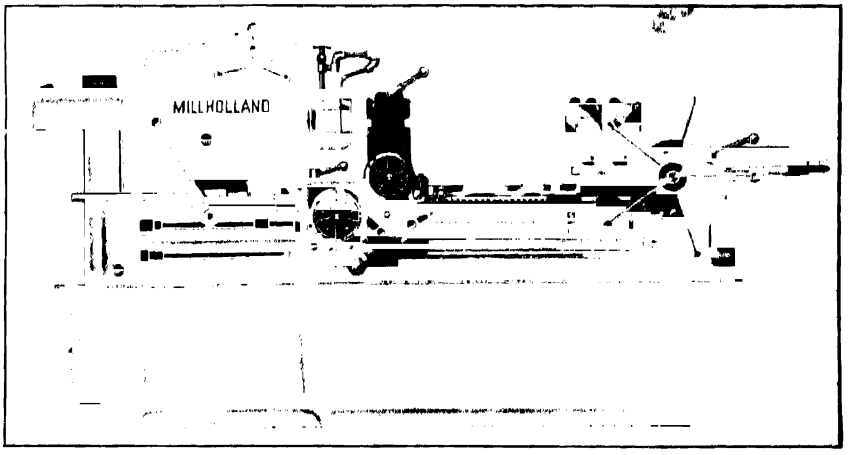
Any compound angle can be instantly obtained with the "Strickland" universal ball joint vise made by Engineering Service, Inc., Box 44, Huntington Park, Calif. A time-saving precision instrument, this device provides quick and accurate settings in any horizontal angular position, any vertical angle combined with any horizontal angle, and any compound vertical angle combined with any horizontal angle. Settings are obtained by



matching the ball joint vertical degree graduation with the horizontal degree graduation required.

Vise is rigidly locked with a single movement of a clamp wrench. An adjustable leather dust apron, not shown, is furnished for protection. Range of the device is 30 deg. through the horizontal plane. Height is 5 in. and width is 5¼ in.

Improved Universal Turret Lathes Built to Provide Increased Rigidity



Greater rigidity through the use of a box section sub-base which extends under the full length of the bed is one of the features of the improved No. 4 universal turret lathe offered by W K. Millholland Machinery Co., 1115 E. 35th St., Indianapolis, Ind. Swinging 20 in. over the ways, and available in 1¼, 2 and 2½-in. bar capacity, this machine has a universal carriage with longitudinal travel of 24 in., and a turret ram with a travel of 12 in

Spindle is mounted in double-row precision Timken roller bearings at the front and a large diameter precision ball bearing at the back. Spindle nose is heat-treated and ground with a taper pilot for mounting chucks, automatic bar chucks, or other work holding equipment. Drive shafts are mounted on selected ball bearings. Both gears and drive shafts are made of alloy steel; shafts are multiple splined and finished after heat-treatment. Headstock has twelve speeds forward and reverse from 35 to 715 r.p.m., with automatic spindle brake.

Bed is of deep box section, well ribbed and with the headstock and bed cast solid. One-piece hardened and ground steel V-ways are provided. Sub-base is of one-piece box construction, and extends under the full length of the bed. Motor is mounted on an adjustable base inside the sub-base with drive to main shaft by multiple V-belts.

Automatic chuck and bar feed are operated by a lever in front of the bed. Chuck has a master collet in which may be attached collet bushings for different sizes and shapes of stock.

Universal carriage is exceptionally heavy, and is provided with both cross and longitudinal feeds, reversible in the apron. There are six feed changes in the apron, with six additional feeds obtained through the gear box at the

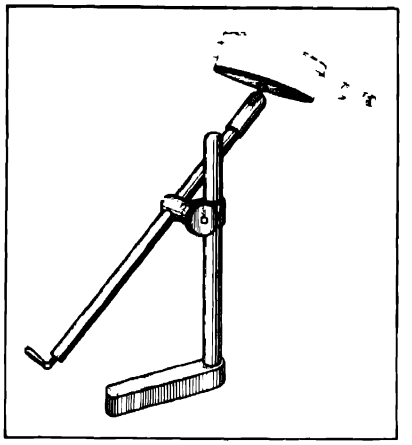
headstock Friction clutches are provided for both cross and longitudinal feeds Feed trip-off for the longitudinal feed is operated automatically by four adjustable-length stops Cross feed has four adjustable stops for tripping the feed in either direction Apron shafts and gears are hardened and run in an oil bath Bearings are anti-friction

Turret slide is operated by a turnstile rack and pinion Turret is of large diameter and revolves on a steel seat to which it is firmly clamped by an automatically operated double bevel clamp All operating functions of the turret are controlled by movement of the turnstile handle Turret saddle has six feed changes in the apron with six more feed changes through the headstock gear box

Turret is bored so that long stock can pass through it Turret feed is engaged by a friction clutch Feeds are automatically tripped by independent adjustable stops

"red E set" Dial Gage Holder Permits Remote Position Control

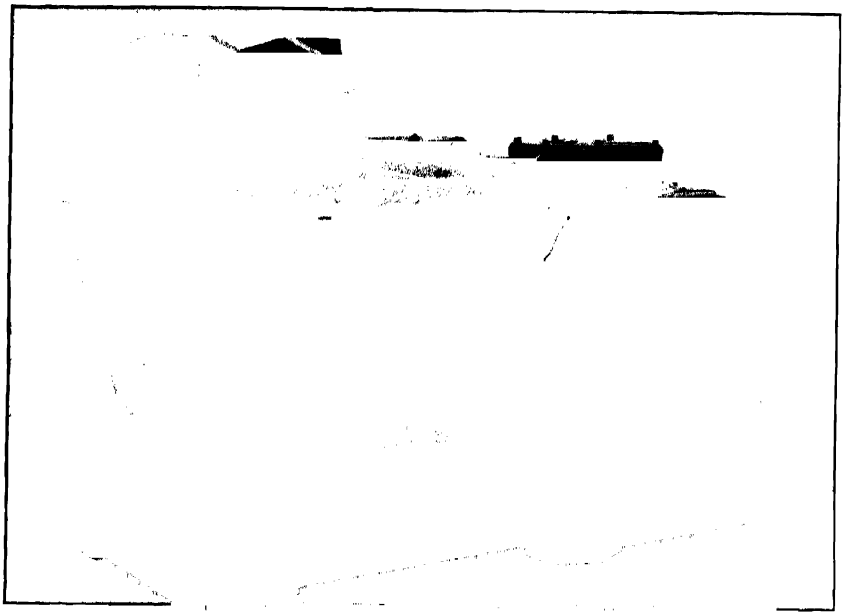
The "red E set" dial indicator holder offered by red E set Co 89 State St, Boston Mass is claimed to be the only holder made with a ball and socket joint and remote control Cap-



able of holding all makes of dial gages both old and new this device has a $\frac{3}{8}$-in square base to fit any toolholder and enables the gage contact point to touch almost any spot with only one adjustment

The primary adjustment easily accessible and 5½ in away from the work does 90 per cent of the adjusting A secondary adjustment permits approximate positioning of the instrument Tubular construction gives maximum rigidity Weight is less than 7 oz

Protection with Accessibility Featured In Design of New Federal Flash Welder



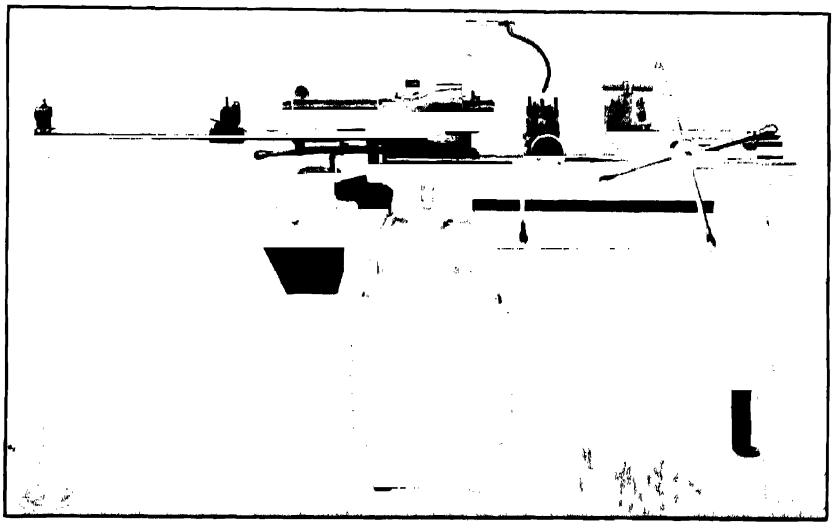
Maximum protection of operating parts without sacrificing accessibility is an outstanding design feature of the Type F-4 flash welder developed by Federal Machine & Welder Co 212 Dana St Warren Ohio This machine is made in transformer capacities up to 150 kva suitable for welding stock having up to 1 sq in of welding area It may be used for round flat or formed sections

Welder incorporates side bar construction which has the effect of a very long slide for the moving platen With this arrangement the slide is continuously lubricated in sealed bearings on each end of the frame supporting members Machine has flat top platens for mounting various types of clamping fixtures Parallel keyways assure accurate alignment of these fixtures

Drive arrangement mounted on the moving platen end of the machine is enclosed and at the same time is accessible by removing the enclosure covers Mechanism is motor driven through a variable-speed transmission and gear reducer Cam which controls the flash and upset period of the weld is covered to protect it from flash and dirt

Brown Underneath-Drive Screw Cutting Machine Employs Easily Operated Belt Shifting Device

Utilizing its recently patented belt shifting device Brown Machine Co 16 N May St Chicago, Ill has developed a new model underneath-drive screw cutting machine The belt is shifted from step to step on the pulleys by a shifting device consisting of two sliding belt guide arms moved by a hand lever located on the front of the cabinet It is unnecessary to



loosen the tension of the belt by a large crank or to raise the headstock cover and shift the belt by hand. Hole through the preloaded Timken bearing mounted alloy steel spindle is 1 in. in diameter. Coolant pump is furnished. Power feed is optional.

Die Handling Time Reduced With Economy "Shoplifter"

Simplicity and economy characterize the "Shoplifter" developed by Economy Engineering Co., 2653 W. Van Buren St., Chicago, Ill., for faster, safer and easier handling of dies. With this machine any workman can pick up a die, transfer it through the plant and lift it onto the press or storage shelf with a minimum of time and effort.

In addition to handling dies, this device is also useful for lifting other heavy metal parts, and for stacking boxes, skids, and drums It can also be used as a truck for materials handling, and can serve as an adjustable table for machine work.

A hand-operated hoist raises and lowers the platform to any desired

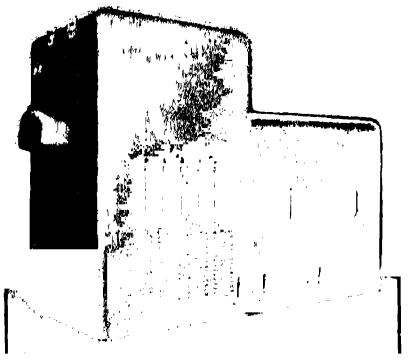


height from 8¼ to 57 in. above the floor. An automatic clutch holds the platform at any height until cranked down. Large wheels make possible easy handling. An arc welded structural steel frame insures rigidity. Capacity of the unit is 500 lb. It weighs 250 lb.

"Lithco" Atmosphere Furnaces Simplify Heat-Treating

Using a specially developed compound having the property of neutralizing furnace gases, the "Lithco" atmosphere furnace developed by Lithium Corp., 175 Fifth Ave., New York, N. Y., permits heat-treatment of iron and alloy and carbon steels without danger of carburization, decarburization, scaling, nitriding or hydrogen embrittlement. In this furnace, steels of different carbon analyses can be heated simultaneously, with no change in the surface analysis of any of them.

Atmosphere in the furnace is claimed to be more than chemically neutral. It is one in which the neutralizing element is in excess. Thus, any oxygen released from water vapor, air, carbon dioxide, carbon monoxide, oxides of nitrogen, adsorbed or occluded gases and vapors, or moisture-contaminated hydrogen or nitrogen is



absorbed by this neutralizer A carrier gas, generated within the furnace, entrains the vapor which evolves continuously from the cartridge refill and bathes the work being heated in this neutralized atmosphere Danger from injurious and highly explosive gases is completely eliminated.

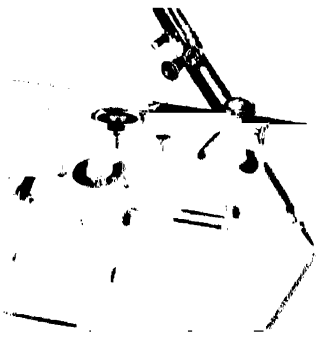
Control of the furnace is fully automatic It is a self-contained unit, with no moving parts Furnaces can be furnished in all sizes of batch and continuous types A pedal-operated ball-bearing ratchet-stop self-locking door is provided Furnace is completely insulated with 12-in walls, with specially designed tunnels and alloy burners Special venting tubes provide recirculation for uniform muffle temperatures.

Portable Gas Cutting Machine Built for Unusual Accuracy

The Model K portable motor-driven gas-cutting machine developed by Harris Calorific Co., Cleveland, Ohio, has been designed with a low chassis and underslung torch holder to eliminate vibration and assure exceptionally true cuts Powered by a universal electric motor, it will cut straight lines of any length with either square or beveled edges and will cut circles from 1 to 86 in. in diameter Machine has a speed range of from 3 to 60 in. per min., forward and reverse. An instant stop feature permits cutting of sharp angles, and a tracing attachment provides for cutting of irregular forms.

Mounting for two torches is provided. Maximum traction is assured by the use of two large hardened drive wheels. Swivel follower wheels provide 4-point support. A one-point oiling feeder line to all bearings provides constant lubrication.

Several different torches are avail-

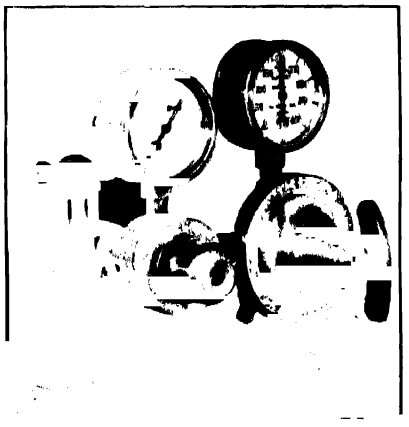


able to permit the machine to use acetylene, propane, natural gas or other fuel gases. Standard equipment includes cutting torch and tip, universal torch mounting, circular cutting attachment and a 5-ft. track. Machine weighs 45 lb. complete.

Milburn Twin-Stage Regulator Features Double Adjustment

An outstanding advantage of the Type FF "Twin-Stage" regulator offered by Alexander Milburn Co., 1416 W. Baltimore St., Baltimore, Md., is that the first stage can be adjusted to various pressures, thus permitting it to be used for different operations. After the selected pressure is set, the delivery stage may be adjusted to any desired working pressure up to 200 lb. per sq in. It operates smoothly and permits uniform delivery.

Promoting simplified construction is



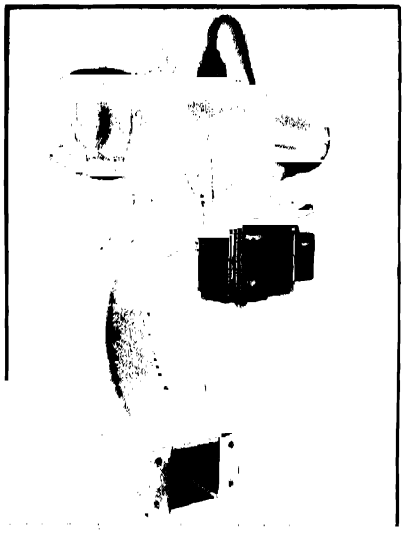
a unitary valve assembly, which is used in both stages. This assembly has only four parts: a small body, stainless steel spring, stainless steel ball, and special Vulcanite seat. These are operated by a Monel metal pin. Seating is with instead of against the pressure. Each stage has a loose, re-

placeable diaphragm, and removable and interchangeable inlets, adaptable to any tank or line connection for any type of gas. Non-corrosive cylindrical filter screens inclose seat units, thus insuring protection from dirt and foreign particles. Bodies and adjusting keys are of forged bronze.

The first stage of this regulator can be purchased separately and attached to practically any type of single-stage regulator, converting it to two-stage control. Only simple adjustments are necessary.

Belt Shifting Eliminated By Lima Gear-Shift Motor

An automotive gear-shift providing instant speed changes without any belt shifting has been made available for machine tool application by Lima Electric Motor Co., a subsidiary of Lima Armature Works, Inc., 440 N. Main St., Lima, Ohio. This unit gives



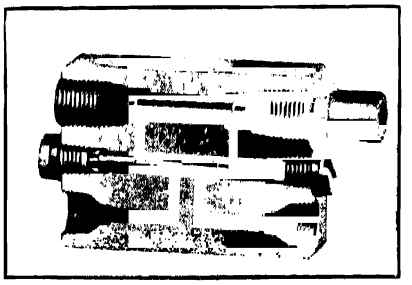
three speeds forward and one reverse, or four speeds forward when reversing can be accomplished through the motor.

Gear-shift is built both as an integral part of the motor and as a separate unit which can be used with any standard motor. A special bracket for mounting on lathes is also made. The device is claimed to increase both safety and production on such tools as lathes, milling machines, planers, drill presses and grinders.

Centralized Lubrication System Applicable to Small Machines

A development in centralized lubrication which brings its advantages to small machine tools has been announced by Farval Corp., Cleveland, Ohio. Known as the "Dualine Jr." system, these installations operate on the same piston displacement principle of measurement as employed for the past twelve years in larger systems on heavier machines. Size has been greatly reduced to provide correct application to small machine tools and other equipment.

In keeping with smaller pumps and measuring valves, a corresponding line of fittings, hose, couplings and

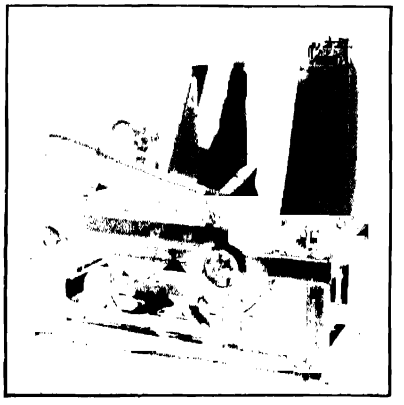


other accessories has been produced. Valve itself has only two moving parts. It contains no springs nor check valves, and is fully adjustable. Positive delivery of lubricant to each bearing is made independently of the judgment of the oiler.

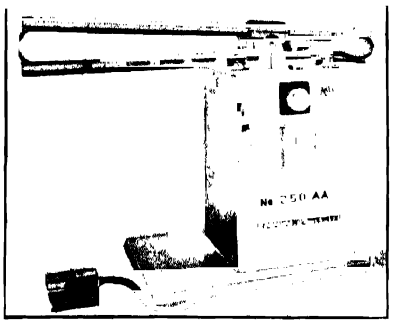
Lyon 5-Ton Elevating Truck Unloads Strip Steel Coils

Designed for unloading coils of strip steel from the recoiling machine, a 10,000-lb. capacity hydraulic elevating truck has been developed by Lyon Iron Works, 538 Madison St., Greene, N. Y., for operation on a track approximately at floor level with the lower portion of the truck in a pit

This truck is of the toggle lever type



for handling coils of steel up to 46 in. in diameter. Platform, 45 in. long, is fitted with an adjustable stop. Platform tilts 15 deg. from horizontal, and is operated from the tandem valve assembly that operates the elevating and lowering of the main platform. Lowered height from track to vertex of platform V is 13½ in. Elevated height 25½ in. Pump is motor-driven by a 3-hp. lowering hoist, and tilting hoist. It is controlled by a tandem four-way valve which is mounted on the truck column. The motor is controlled by a pushbutton and magnetic starter, and is equipped with cable reel and cable.



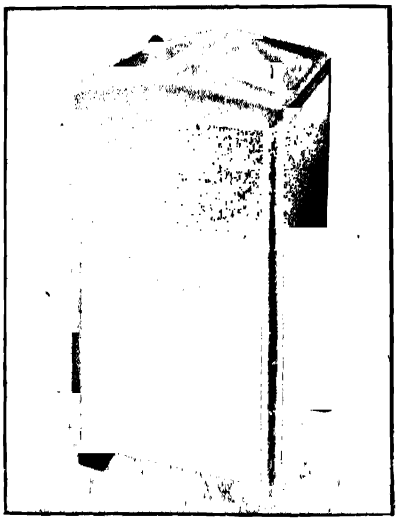
Long-Horn Spot Welder Has 50-kva. Capacity

Eisler Engineering Co., 745 S. 13th St., Newark, N. J., has developed a long-horn spot welder for deep sheet metal work. On this No. 250 AA machine both upper and lower horns can be lengthened or shortened. Horn adjustment makes it possible to weld light and heavy work and deep metal parts. Markings on the horn represent kva. ratings. Model illustrated is a 25–50 kva. air-operated welder. Cooling water goes through entire horn.

G.E. Industrial Water Cooler Is Entirely Self-Contained

General Electric Co., Bloomfield, N. J., has developed a high-capacity double-bubbler water cooler especially for use in heavy manufacturing plants, steel mills, and other industrial locations where workmen require plenty of drinking water. Identified as the Type RM-05, this cooler is entirely self-contained in a sturdy, rust-resistant, all-steel welded cabinet. Top is of stainless steel, drawn in one piece, with integral drain bowls to eliminate splashing.

Large reserve capacity to meet peak loads is provided by a 10-gal. stainless steel storage tank, and by an oversized compressor motor (¾ hp.) which is only 87 per cent loaded. Cooling chamber is refrigerated by a helically wound coil of silver-filled copper tubing. Cooling unit is insulated with



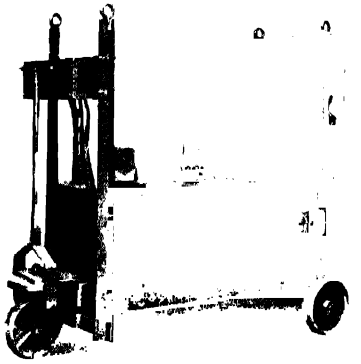
granulated cork, sealed in steel for protection against condensation

Other features include an automatic stream regulator, a heat interchanger which improves performance automatic temperature control with a high-pressure cutout, and a "Thermotector" to protect the compressor motor

To maintain efficient operation in hot working areas the condenser is cooled by water instead of air In addition, motor and compressor heat is removed by a special finned water coil over which air is circulated by a four-blade fan For operation in shipyards or other unheated space "freeze-proof" accessories are available

Hysteresis Heating System Used in Field or Shop

The Smith-Dolan induction hysteresis preheating-welding-normalizing system as developed by Electric Arc Cutting & Welding Co 152-156 Jelliff Ave Newark N J is suitable for field work on pipe and special pressure vessel connections and for similar work in the shop Illustrated is a 90-



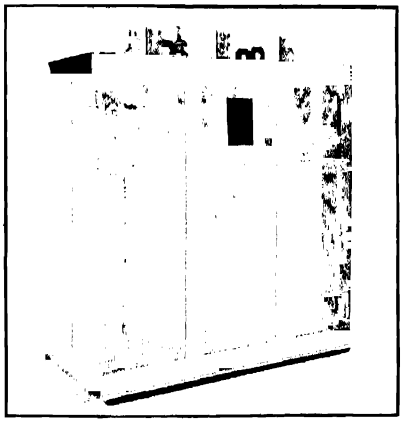
kw preheating-welding-normalizing shop machine for vessels which require more accurate control than obtainable with furnace gas or oil heating

Special vessels of alloy steels requiring accurate heating control are conveniently handled by this system Those with many connections or requiring too many trips into or out of the furnace are also said to be more economically treated in this manner

Safety Outstanding Feature Of Air-Cooled Transformer

An air-cooled transformer claimed to provide a higher factor of operating safety than even before realized has been developed by Westinghouse Electric & Mfg Co, East Pittsburgh Pa With 60 cycle ratings ranging from 150 to 500 kva for single phase and 150 to 1,000 kva for three phase, at voltages of 13,200 and less these Type ASL transformers are designed specifically for installations in buildings where safety is essential Because no fire and explosion hazards exist with this design, substantial savings are effected by the elimination of protective vaults Improved regulation and increased output are obtained because these transformers may be located near the load center thus permitting short secondary cables

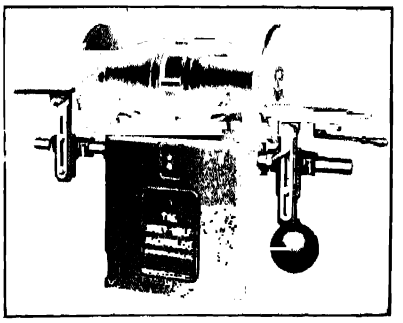
Housing is constructed of expanded metal finished in a black baked-on moisture-proof enamel which permits free flow of air from all sides and prevents accidental contact with live terminals Primary and secondary coils



are separated by liberal spaces through which a stream of air constantly circulates Windings are designed for 75 C temperature rise under continuous full-load operation Heat-resisting insulations are used throughout allowing operation at higher temperatures than permissible with liquid-filled transformers

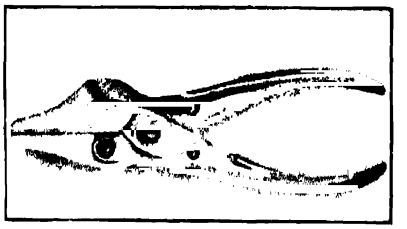
"Hisey" Disk Grinders Embody Improved Construction

Among the design improvements effected in the direct drive disk grinders made by Hisey-Wolf Machine Co Cincinnati Ohio are extra heavy end bells with feet which carry the bear-



ing directly behind the disk Bearing construction has also been improved as has the method of lubrication Oilers are of the constant level type with sight supply

Motor is totally inclosed with a circulation of air passing through the motor, through the feet of the end bells into the pedestal, and back through the motor again Machine, which is made in sizes from 3 to 10 hp, can be supplied with guards having exhaust connections Combination machines can also be furnished with a disk on one end and a grinding wheel or buffing extension on the other



Improved "Bernard" Pliers Have Larger Jaw Openings

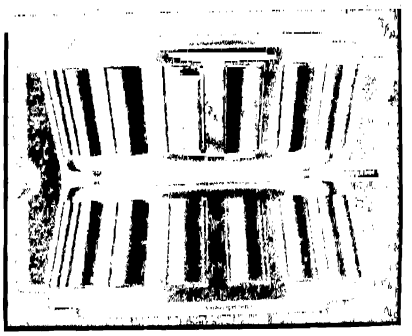
The improved No 402 6-in "Bernard" pliers offered by William Schollhorn Co, 414 Chapel St, New Haven, Conn, have a 25 per cent greater jaw opening and longer tapering jaws which make possible their use in smaller spaces Similar to former parallel-action pliers these tools retain such features as an open throat through which wire may be fed, compound leverage for increased power, and outside cutting jaws

Modified Timken Bearing Suitable for Sheave Use

Timken Roller Bearing Co Canton, Ohio has modified its standard Type NA non-adjustable roller bearing to make it especially adaptable as a sheave bearing Made up of a double row outer race and two single row inner races this bearing has all parts ground to established precision limits

Front cone faces are slotted and chamfered to provide passage for the lubricant into the bearing interior This is of advantage in multiple-sheave blocks where the bearings must be lubricated through the stationary pin

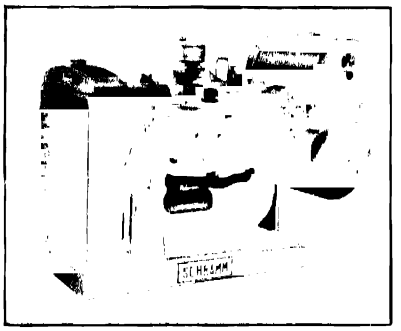
Sealing the bearing chamber has been greatly simplified by extending the length of the large cone rib and creating a surface concentric with the shaft and sheave bore on which a seal may run These seals have the same outside diameter as the cup and are



pressed into the sheave bore, thus holding the bearing together during assembly Bearing is designed to a minimum width and with an inside diameter large in relation to its outside diameter Being an anti-friction thrust bearing as well as an anti-friction radial bearing, it rotates freely without axial float Thus wear between sheaves and side plates is eliminated

Schramm "Fordair" Compressor Built With Stationary Mounting

Replacing the Model No 55, the Model No 60 "Fordair" air compressor built by Schramm, Inc, West Chester, Pa, delivers about 8 per cent more air without any increase in dimensions



or weight Available in stationary mountings the engine and compressor are built into one V-block for compactness and better performance

Units are complete with a built-in cooling system, water pumps being supplied to insure positive temperature control They have complete electric starting systems, including battery, starter controls starting motor, and battery generator

With these self-contained compressors air can be had at a moment's notice and without installation foundations They are available with fuel and air tanks mounted or without these accessories for the shop with an air system already installed

For the large shops these units are said to make ideal boosters to supply the little extra air sometimes needed Other large shops find it economical to have several of these units scattered about the shop with an air system already installed For those having natural or manufactured gas these compressors can be adapted to operate on gas rather than gasoline

Sterling Pump Motor Built for Easy Mounting

Sterling Electric Motors, Inc, Telegraph Rd & Atlantic Blvd, Los Angeles, Calif, has developed a line of standard dimension motors especially for easy mounting of centrifugal and similar pumps

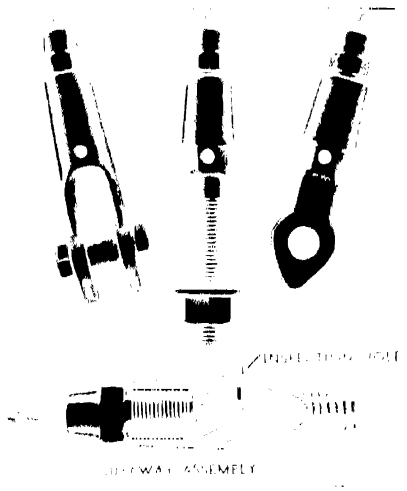
These ball-bearing motors have



ratings from ½ to 40 hp for operation on three phase at 2-, 4- and 6-pole speeds Extended shafts and machined fits for the pump mounting are all standard and the same dimensions throughout the entire range of ratings A large Neoprene washer on the shaft between the pump packing and motor bearing, in combination with a trough cast around the bearing, makes it practically impossible for any of the material pumped to find its way into the motor bearing The projecting shaft is covered with a special hard stainless steel tube which is ground and polished at the time the shaft is made

Improved Wire Rope Connector Prevents Cable Crystallization

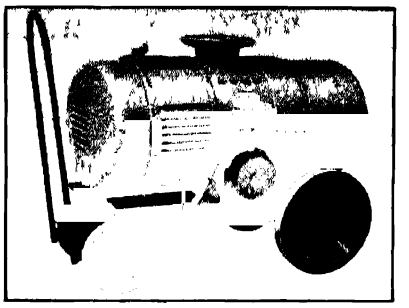
Improved "Electroline-Fiege" connectors offered by Electroline Co 4054 S LaSalle St Chicago Ill, are said to damp line vibration and grip the cable with a graduated compression preventing crystallization at the point of connection and thus promoting longer rope life Connectors con-



sist of three simple units: a sleeve which fits over the end of the wire rope, a tapered plug which is inserted to separate and hold the strands of wire in the sleeve, and a covering socket which securely locks the cable Installation is made with ordinary mechanics tools These connectors are available in black, hot galvanized and cadmium plated steel, and in bronze, stainless steel and monel metal for rope sizes under ½ in

Dual Voltage Switch Made for Arc Welders

Wilson Welder & Metals Co, Inc, 60 E 42nd St, New York, N Y, has developed a dual voltage switch for installation on arc welding machines when they must be used on either of

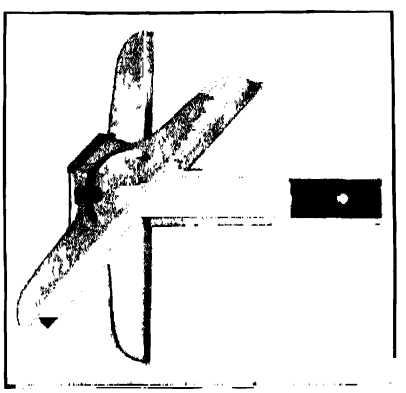


two line voltages at different times This device, known as the Type CH switch, can be used on any motor employing alternating current provided the motor and starter are reconnectable for two voltages

With this switch, the change from one voltage to another can be made in less than one minute Raised figures indicate the line voltage for which the switch is set Unit has two main parts—a base mounted directly on the machine, and a removable top cover This cover can be set on the base in two positions one for each voltage

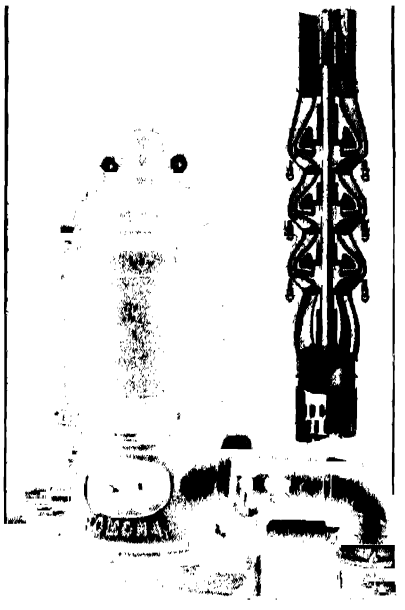
Stainless Steel T-Square Has Pivoted "Alumilite" Head

Transparent edges and pivoted "Alumilite" metal heads are outstanding features of the No 30 stainless steel T-square offered by Turner Devices Inc, 1212 Mississippi Ave, St Louis, Mo These T-squares embody the permanent accuracy of metal, as they are non-warpable and are not affected by atmospheric changes Double channel construction insures rigidity Narrow blade covers a minimum of drawing and transparent edges are secured by dovetail edges instead of cement Blade glides on two hard rounded surfaces that are claimed not to soil work nor collect dust



Vertical Turbine Pump Redesigned for Economy

Pomona Pump Co, 660 E Commercial St, Pomona, Calif, has completely redesigned its line of 6-in medium capacity vertical turbine pumps to increase efficiency and performance As



a result of newly designed impellers only a 7½-hp motor is required as against a 10-hp motor for the same capacity with the older model The number of stages has been reduced one-fourth and the initial cost is lowered 20 per cent

Other advantages of these pumps include water lubrication with no stuffing box below ground level a specially designed semi-open impeller which can be adjusted from the surface for wear, and non-sandlocking and non-gaslocking characteristics Constructed of high quality bronze the impellers operate in cone-shaped seats in the pump bowls Impeller vane curvature is said to insure maximum lifting capacity without overloading the motor regardless of changes in water level

Stearns Magnetic Separator Uses Alternating Current

An unusual type of magnetic separator which utilizes alternating current for energizing the magnetic field has been developed by Stearns Magnetic Mfg Co Milwaukee Wis especially for separating finely ground powdered metal which may be contaminated by impurities such as oxide scale charcoal silica or other small particles Identified as the Type AM this separator is claimed to be unusually effective since the material affected by the magnet receives 120 pulsations per second of constant agitation

Material is spread uniformly by an adjustable vibrating feeder which pro-

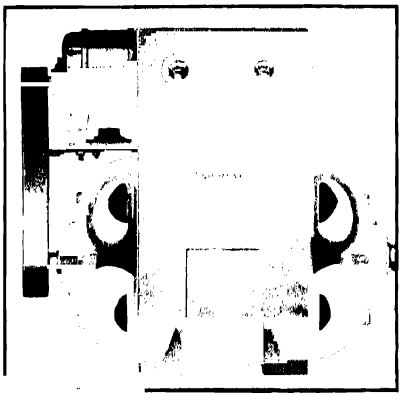


vides even distribution on the belt where it is picked up by the magnet and carried along the underside of the separating belt The high pulsating effect of the magnet frees the nonmagnetic impurities allowing them to drop out Under ordinary conditions three products can be produced—tails middlings and concentrates

While the separator is fully inclosed in a structural steel frame practically dust-tight provision is made for removable panels by which the material can be inspected while the separator is in operation Bearings requiring oiling and other attention are mounted on the outside for ready accessibility An exhaust fan is directly attached to remove dust from the material while in process

Integral Exciter and Control Provided in a.c. Power Unit

A completely self-contained a c generating unit which regulates controls and meters its output has been an-



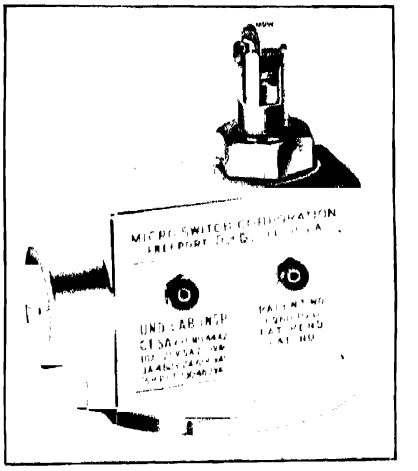
nounced by Westinghouse Electric & Mfg Co East Pittsburgh Pa Called the Simpac power unit it combines a standard open-type a c generator a d c exciter exciter field rheostat voltmeter ammeter and optional voltage regulator in one integral unit Designed especially for special requirements in industrial plants it may be either engine or electric motor driven direct or belt connected

Construction is simple yet rigid and strong Exciter is mounted on a fabricated steel shelf above the generator and is driven off the generator shaft extension by a V-belt Control regulator, and meters are enclosed in a sheet steel cabinet fastened to one side of the generator frame Voltage is adjusted manually by the exciter field rheostat the voltmeter being in plain sight Generator has an inherent voltage regulation of 10 per cent at 0 8 power factor Ratings from 3 75 to 187 kva are available at voltages of 120/128 240 or 480 with operating speeds from 600 to 1 800 r p m Units above 187 and up to 312 kva may be obtained with separately mounted controls All come wired and assembled ready for installation

Die Cast Micro Switch Has Roller Type Plunger

Micro Switch Corp Freeport Ill has made available a die cast micro switch with a roller-type plunger having a brass bushing which accepts the roller either longitudinally or crosswise

Long life and precision performance from this type of actuator are assured by accurate concentricity of the hard-



ened and ground roller which is carried on an oilless bearing Adjustment for actuation by cam or slide in either of the two positions is quickly made by removal of the bearing screw Die cast housing is available in either zinc or aluminum

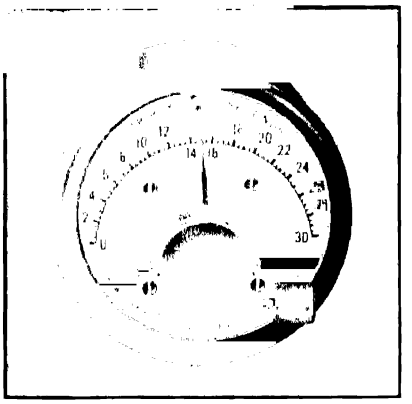
Switching element is the basic micro switch a small single-pole snap-action switch having a rating of 1 200 watts up to 600 volts a c It may be furnished with normally closed normally open or double throw contacts

Improved Micrometer Adjustment Permits Accurate Relay Setting

An improved micrometer adjusting knob and indicator incorporated in the latest types of automatic reset timers and time delay relays offered

by R W Cramer Co, Centerbrook, Conn, permits accurate adjustment of timer settings Device is said to be simple, neat, and exceptionally rugged

A knurled knob drives a worm gear which slowly moves a pointer around the dial Since the pointer is brought to a fine edge which travels across an

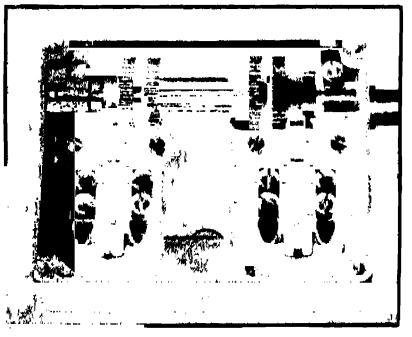


easily read scale, accurate settings can be achieved with little effort Instruments can be reset to virtually identical values with slight effort, and tiny changes in adjustment of the time interval are possible by a small twist of the knob

Geared-Type Limit Switch Operates From Rotating Shaft

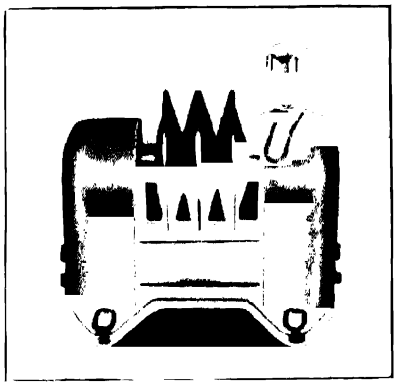
A small geared-type limit switch developed by General Electric Co Schenectady, N Y, has been designed for application on motor-driven devices where it is necessary to limit the rotation of the motor shaft or some rotating shaft member on the driven machine, one of the most important applications being on certain types of machine tools

In use, the switch shaft (usually



direct-connected to an electric motor) serves as a driving gear, turning the pinion shaft. This shaft engages driving gears which move along the drive screw toward one of the operating gears at either end At the end of travel in either direction, a pin on the traveling gear engages a pin on the operating gear This causes the operating gear, cam, and safety pin, which are a unit, to rotate and move the switch contact arm to a high part of the cam, operating the contacts. These contacts are designed for 125-volt 4-amp a c operation and 125-volt 1-amp d c. service.

Some of the features of the new switch are double-break, fine silver contacts which clean themselves with a rocking motion, and a mechanism easily adjusted to operate contact between a minimum of ½ turn of the driving shaft to a maximum of 120 turns, an over-travel of 3½ turns being provided to prevent accidental damage to switch mechanism. Case measures only $4\frac{1}{16}$ x 3½ x $1\frac{13}{16}$ in



"All-Speed" Transmission Suitable for Machine Tools

A V-belt variable speed transmission, known as the "All Speed," is offered by Standard Transmission Equipment Co Suite 330, 416 W 8th St, Los Angeles, Calif This speed selector operates on the variable pulley principle, consisting of two interlocking pulleys mounted on a common shaft The variable speed spindle can be pivoted laterally between the motor and the driven machine to provide new running diameters on the interlocking pulleys Speed selected is maintained by a lock nut on the control quadrant, and the oblique slot automatically guides the spindle at all times to insure proper alignment

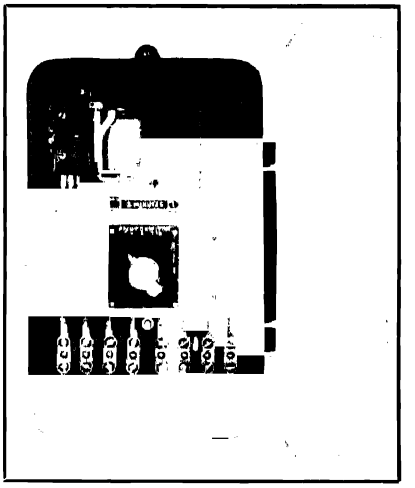
Special impregnated bronze bearings are used The unit is made in three sizes for ⅛-in, A and B belts It is available in speed ranges up to 12 to 1

Short Interval Timer Built for Accuracy

The Type T 15 electronic timer developed by Photoswitch, Inc, 21 Chestnut St, Cambridge, Mass, is said to be extremely accurate over ranges from 1 20th of a second to two minutes Control is accomplished through a specially designed snap-action relay of 1,000 watts capacity, giving an accuracy hitherto unapproached in simple and rugged timers

Equipment is flexible with reference to actuating control, permitting both momentary pushbutton and sustaining contact control It is universal for six timing ranges represented by timing valves snapped into a readily accessible clip.

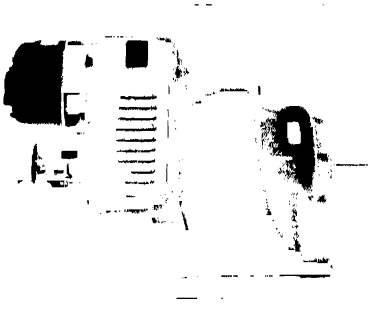
Timer has been built with an accuracy permitting complete inter-



changeability of equipment Thus machine process calibrations for one timer apply to all timers Unit has been designed throughout for life guaranteed to match that of any machine to which it is applied

"Varidrive-Syncrogear" Units Feature Greater Compactness

Units which are more compact, smaller and lighter are achieved through the elimination of a sub-base on the Type VEV-GD and VEV-GT "Varidrive" gearmotor offered by U.S Electrical



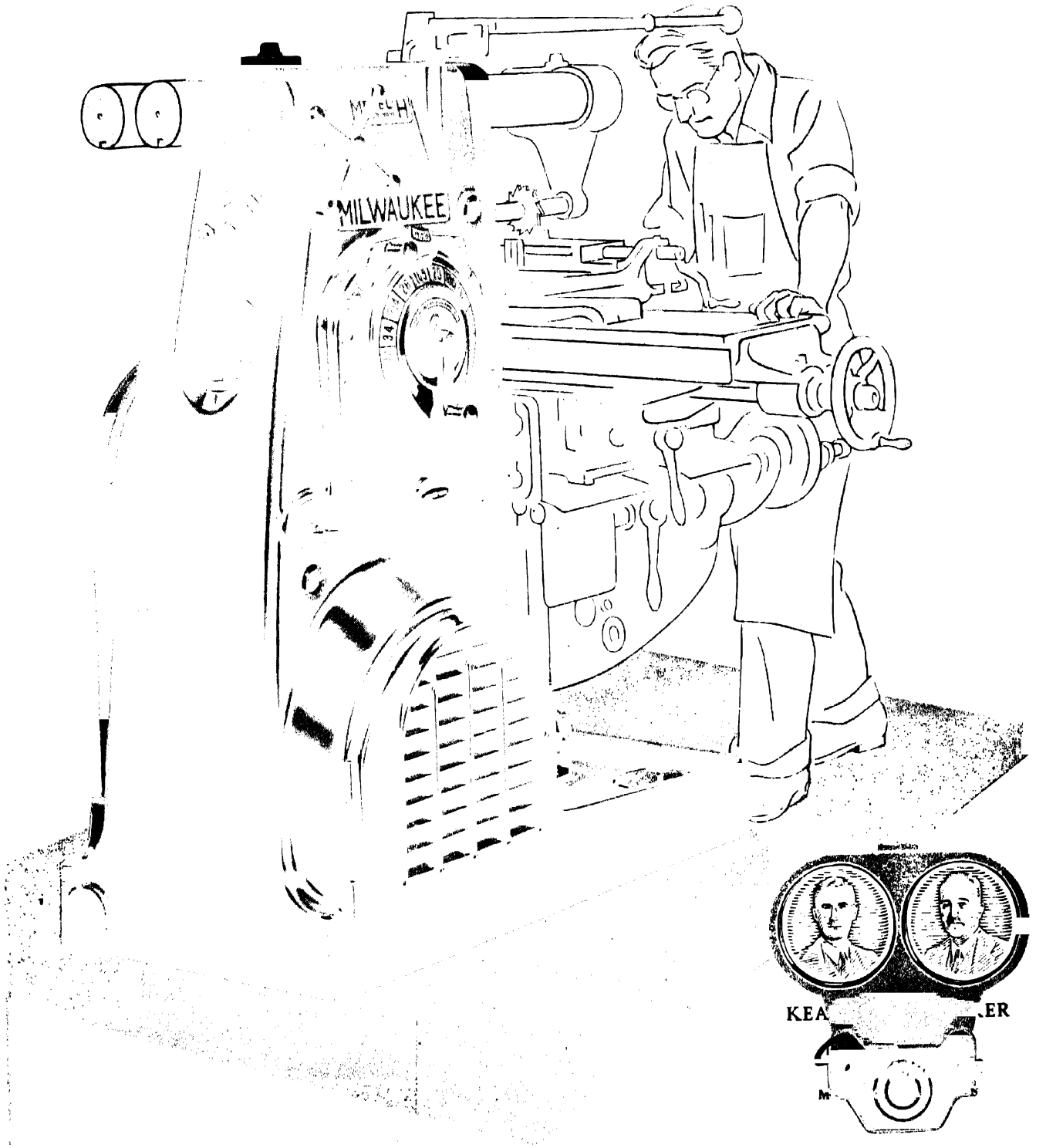
Motors, Inc, 80 34th St, Brooklyn, N Y These motors have double reduction and triple reduction gears for low-speed drives

Further modification of the former design is the mounting of the "Varidrive" case at any angle with respect to the gear case Thus if the unit is to be mounted where headroom is low, the case may be laid over on its side to provide clearance Pyramidal gear pedestal provides both a rigid mounting for the "Varidrive" case and a sturdy "Syncrogear" motor capable of withstanding the heavy torsional stresses resulting from heavy loads at low speed

Tooth surfaces of all gears are hardened to 55–65 Scleroscope, providing maximum life Pinion cores are ex-

The productive capacity of a milling machine depends more upon its rigidity than on any one other factor. Rigidity originates in the column — the backbone of the machine. Examine the column of a Milwaukee Milling Machine and you will see that it has been carefully engineered for the proper distribution of metal. An inside horizontal wall divides it into a double box section; the cross mounting of the motor permits a solid rear wall, which together with the solid front face, assures an unusually rigid structure.

KEARNEY & TRECKER CORPORATION • Milwaukee, Wis., U. S. A.

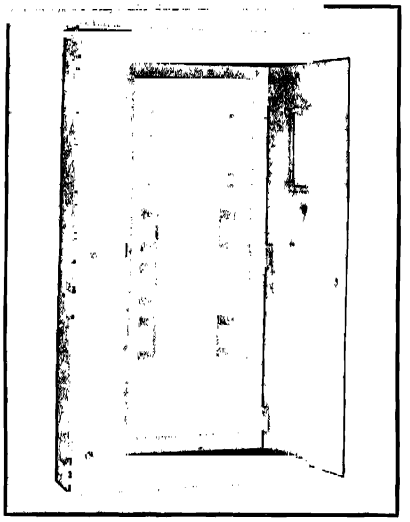


MILWAUKEE MILLING MACHINES

tremely tough and of proper ductility to assure maximum fatigue resistance necessary to withstand severe shock stresses

Breaker Panel Board Made Available by Square D

Square D Co, Detroit, Mich, has developed a Type MH "Multi-breakeR" distribution panel board to provide circuit breaker protection for power and light distribution circuits of 100 amp, 230 volt capacity Individual

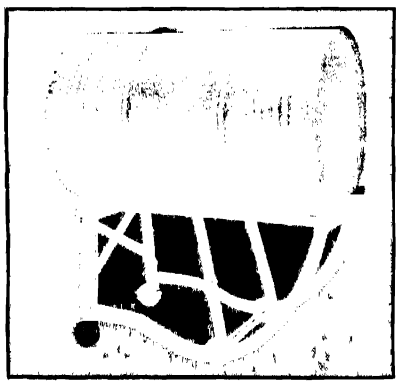


breakers are furnished in 15 to 100 amp capacity, of 1- 2- or 3-pole for 115- and 230-volt single phase and three phase a c systems

The panels are completely dead front—no live parts are exposed even when restoring service after an overload Simple construction insures long life, and compactness of the panels permits them to be easily installed on rewiring jobs

Morse Drum Cradle Truck Features Ease of Loading

Ease of loading is one of the principal features of the No 45 drum cradle truck announced by Morse Mfg Co, 304 W Jefferson St Syracuse, N Y Construction of this truck provides a substantial wheelbase well under the center of gravity of the drum Two wheels are



mounted on a straight axle and the other two are mounted on casters to provide maximum tread width Shape of the frame is such that it may be loaded and unloaded simply by tipping

"Ideal" Storage Battery Developed for Flashlight

A rechargeable flashlight battery similar in principle to the automobile storage battery has been developed by Ideal Commutator Dresser Co, 1057 Park Ave Sycamore Ill Although small enough to fit all popular two-cell flashlights this battery is said to give dependable long life and to be economical in heavy duty service

The battery permits considerable savings for large users of flashlights, as it can be charged repeatedly In heavy use one discharge is equal to a pair of ordinary dry cells The rechargeable feature makes it convenient to use only while the light is



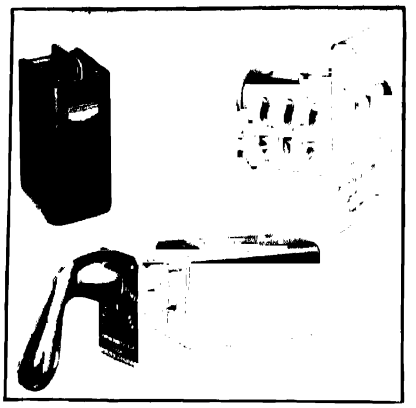
bright and to charge again when the light gets dim

A specially designed chamber and vent and semi-fixation of the electrolyte make the battery spill-proof Plates are over ¼ in thick and are connected to terminals by reinforced electrodes to withstand rough handling Case is of transparent Lucite

A small charger consisting of a transformer and rectifier plugs into any 110-volt 60-cycle socket Recommended charging time is 12 hours

Three-Wire Drum Control Built for Machine Tools

Cutler-Hammer, Inc 205 N 12th St Milwaukee Wis has developed a drum type master switch providing three-wire control, which is said to be particularly adaptable to machine tools This type of switch provides the function equivalent to two or three button heavy duty pushbutton stations, and is superior for use when



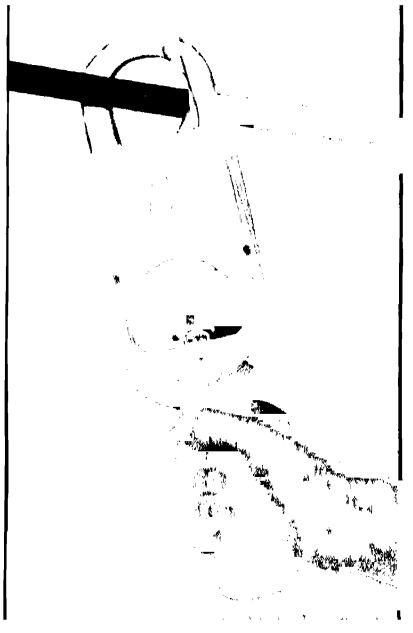
an operating lever is preferred to button

Unit can be furnished for surface, cavity or panel mounting and with either standard or pistol-grip handle By removing a stop post the drum may be converted from non-reversing to reversing Nameplate is marked on one side for reversing service and on the other side for non-reversing thus making it suitable for either application Rating of the switch is for pilot circuits up to 600 volts a c and d c

Hook-on Volt-Ammeter Speeds up Test Work

The Type AK-1 portable hook-on volt-ammeter for measuring alternating current and voltage has been introduced by General Electric Co, Schenectady N Y With it alternating current can be read instantaneously on both insulated and non-insulated conductors simply by hooking the instrument around the line For voltage readings it is necessary only to connect two leads furnished with the instrument and then flip the thumb-manipulated selector switch to the desired voltage position on the scale

Designed for use on conductors of

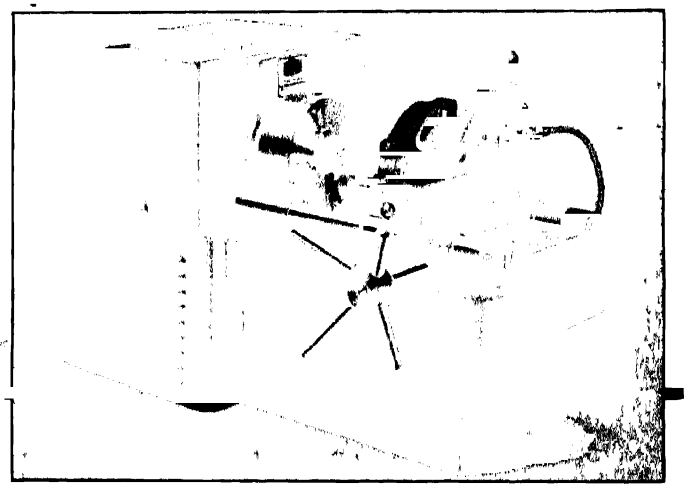


The New "TOM THUMB" PIPE THREADER

OSTER



Study these modern features



1. MODERN DESIGN—all BALL BEARING construction.
2. COMPLETE RANGE—1/2" to 2"—up to 8" with drive shaft.
3. DIE-HEAD—quick-opening, fully adjustable—heavily built.
4. DIES—High Speed Steel.
5. CUT-OFF DEVICE—High Speed Steel, lathe type tool with V Block steady rest.
6. REAMING AND CHAMFERING DEVICE—High Speed Steel forming tool does both operations at the same time.
7. TWO CHUCKS—front chuck, bar operated, three jaw, gripping—rear chuck, three jaw, wheel operated, centering. Both chucks, quick acting.
8. MOTOR—Black & Decker, 1/2 H.P. universal, reversible, variable speed—light socket operation.
9. WORM GEAR DRIVE—hardened and ground, steel worm with bronze worm gear.

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UNEQUALLED CHECK-UPS

eliminate the "Doubtful Few"



Some of the scientific check-ups in the 16-Point Quality-Control routine



. . . when Parker-Kalon's Quality-Control Laboratory backs your fastening devices

You get an unequalled protection against time-wasting, cost-boosting "duds" among your fastening devices when you specify Parker-Kalon! For, in Parker-Kalon's plant, an unusual Quality-Control Laboratory stands guard over all production, to eliminate the "doubtful few" screws that slow-up assembly work and produce unsatisfactory fastenings.

Without counterpart in the industry, this scientific Laboratory sets standards of quality that could never be maintained without rigid quality-control of every production step from chemical analysis of the metal to micrometric check-up of finished dimensions. It insures that every Parker-Kalon Fastening Device is more than "good enough" in both accuracy and strength.

Take no chances in your assembly jobs . . . buy Hardened Self-tapping Screws, Socket Screws or other fastening devices that are made in the screw industry's most modern plant. Parker-Kalon Corporation, 194-196 Varick Street, New York.

SOLD ONLY THROUGH RECOGNIZED DISTRIBUTORS

Quality-Controlled **PARKER-KALON Fastening Devices**

2-in. maximum diameter, this instrument is small enough to get into tight places, light enough to be hung from a lineman's belt, and sufficiently accurate for a great variety of measuring jobs. Weighing only 3½ lb., it is designed for easy, one-hand operation. Four current ranges, 0–15/60/150/600 amp., and two voltage ranges, 0–150/600 volts are available at the setting of a convenient six-position snap switch.

Goodrich Air Hose Stands Excessive Hot Oil Service

Recommended for use where excessive hot oil conditions are encountered, an air hose made with a synthetic tube and rubber cover has been developed by B. F. Goodrich Co., Akron, Ohio. Known as the Type 54, this hose is said to give two to three times longer service when exposed to the same conditions as a tube made of natural rubber. It is built with a smooth, abrasion-resistant cover.

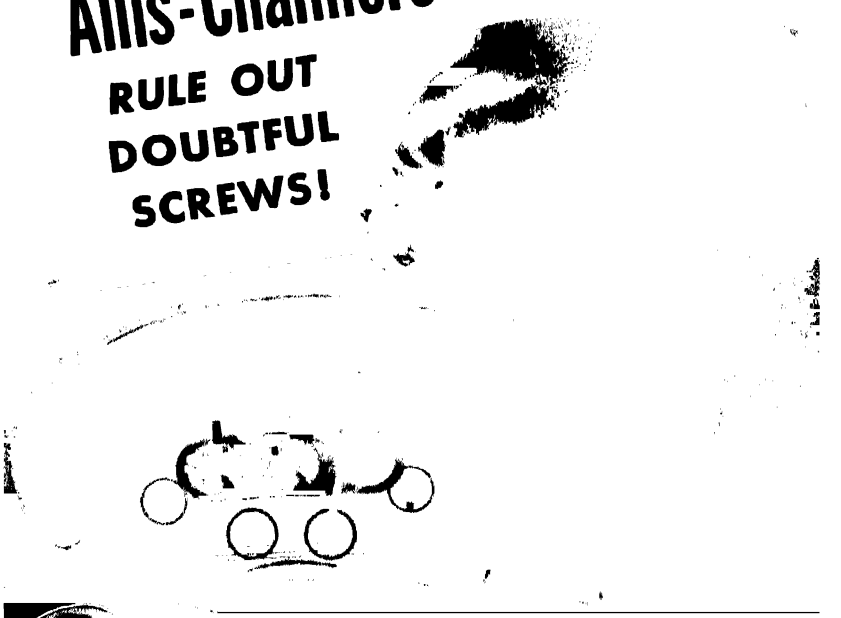
"Electromatic" Spring Wire Produced by New Process

"Electromatic" oil tempered wire for special mechanical springs is now being produced by an electric direct resistance method by Jones & Laughlin Steel Corp, Pittsburgh, Pa In contrast to the conventional methods of heating wire to quenching temperatures, either in furnaces or by immersion in molten baths, this process consists of passing sufficient electric current through the wire to heat it Electrical resistance in the wire increases its temperature uniformly, with the full cross-section heated simultaneously to the desired quenching temperature.

The new equipment handles a wide variety of gages, and is so constructed that wire fed from reels passes first through tension rollers, then through a molten electrical contact From there, the wire passes through a second molten contact, completing the electric circuit. These contacts are held at a constant temperature, the second also serving as a primary quenching bath from which the wire immediately passes to an oil bath for the final quench. This double-phase quenching provides a gradual reduction in wire temperature, preventing the steel from being shocked. Continuing from the final quench through a molten tempering bath, the wire is reheated to give it the desired physical properties and fatigue values.

Fundamental advantage of the process is the exactness with which all factors affecting the ultimate quality of the wire are readily controlled. The constant flow of current of controlled voltage and amperage, together with the closely regulated speed of the machine, governs heating to within precise limits. In addition, thermocouples in all contact, quench, and temper baths provide automatic

Allis-Chalmers
RULE OUT DOUBTFUL SCREWS!



No "doubtful" screws for this transformer case!

They Specify QUALITY-CONTROLLED PARKER-KALON SOCKET SCREWS

Careful buyers like Allis-Chalmers take no chances on "doubtful" socket screws in their equipment. They specify Parker-Kalon and escape the "doubtful few" . . . those few imperfect screws in a box that might delay assembly work or fail in service.

Parker-Kalon Socket Screws are produced under a rigid control routine made possible only by Parker-Kalon's unique Quality-Control Laboratory. Sixteen exacting tests and inspections insure that every screw in a box is "better than good enough."

Specify Parker-Kalon next time . . . they cost no more. Look for the Quality-Control Guarantee that vouches for their extra quality. For free samples and distributor's name, write: Parker-Kalon Corporation, 202 Varick Street, New York.



Quality-Controlled

16-point test and inspection routine covers: Chemical Analysis; Tensile and Torsional Strength; Ductility; Shock Resistance under Tension and Shear; Hardness; Head diameter, height and concentricity; Socket shape, size, depth and centricality; Class 3 Fit Threads; Clean-starting Threads.



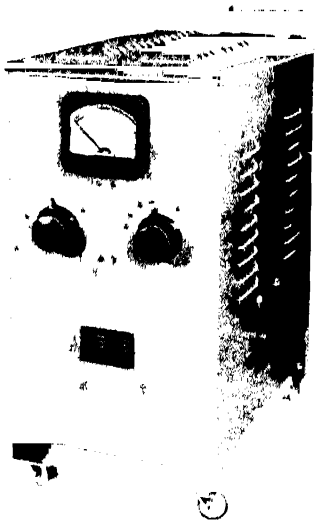
PARKER-KALON
COLD-FORGED
Socket Screws

temperature control over these units The resulting combination of accurate time and temperature regulation makes possible accurate control of the heating and quenching cycle

As length of heating time and control of quenching temperatures have a direct effect on grain structure this method makes it possible to control and reproduce desired grain sizes with great accuracy Double-phase quenching has been found considerably to improve physical characteristics, making possible close control of tensile strength elastic limit elongation and Rockwell values Also as all the heat is within the wire itself, decarburization and scaling are controlled within narrow limits

Portable Testing Rectifier Provides Seven Voltages

The Model SP-20 rectifier made by Mellaphone Corp Rochester N Y designed especially to provide direct current from an alternating current source for testing purposes provides output voltages of 32 110 115 120 210 225 and 240 volts Voltage which is adjusted by knobs on the front



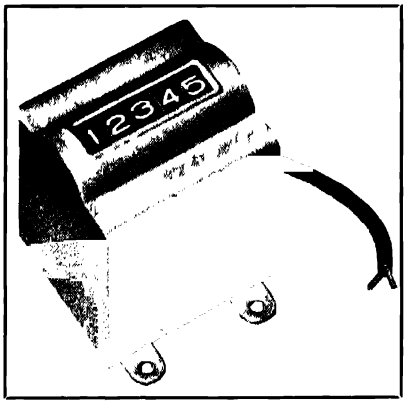
panel is indicated on a meter mounted in the panel

Current capacity of the rectifier is 30 amp at 32 volts d c and 20 amp at all other voltages Two mercury vapor tubes are used to obtain full-wave rectification of the single-phase a c Output voltage is claimed to remain practically constant from no load to 25 per cent overload Rectifier contains no moving parts

Compact Electric Counter Made by Production Instrument

A small electric counter which has been developed especially to meet the demand for a dependable low-cost magnetic counter has been announced by Production Instrument Co , 702–06 W Jackson Blvd , Chicago Ill Known as the "Mercury" counter this device consumes only 2 watts insuring long life to switch contact points and making the instrument particularly suited for electric eye operation The device will operate at up to 600 counts per minute

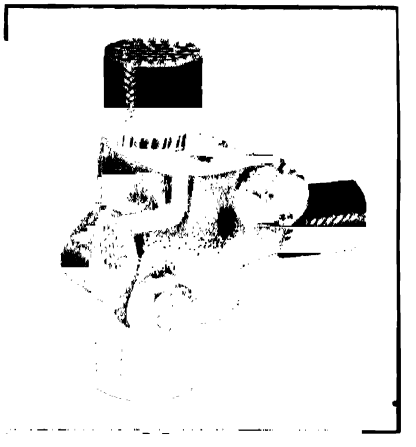
Tamper-proof construction, non-reset feature totally inclosed assembly and convenient mounting make the counter suitable for built-in applications Case and frame are of



cadmium-finished steel with an unbreakable plastic window Five number wheels record to 99 999 and repeat Counters are available for 60-cycle a c for voltages up to 230 and for d c for voltages up to 115

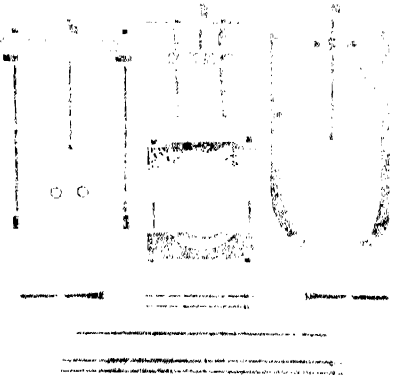
Burndy Electrical Connector Has Several Distinct Uses

The type QPX Versitap offered by Burndy Engineering Co 459 E 133rd St New York N Y is a connector that may be used as a parallel tap a T-connector a cross connector and as an end-to-end connector It will



clamp a large range and combination of cable sizes in either the main or branch connection grooves is installed with an ordinary wrench and is easily taped The connector is made of high strength materials for those parts which carry mechanical stress and of high electrical conductivity materials for those parts which carry current Ten sizes make the device especially suitable for industrial wiring

Correction—Owatonna Tool

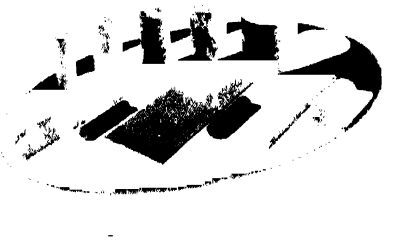


When mounted on a 4x4 ft board the industrial puller set made by Owatonna Tool Co , 353 Cedar St Owatonna Minn , looks like this—not as shown on page 596 of 1 of 84 where the cut was inverted

NEW MATERIALS

"Oilite" Bearing Metal Available in Bar Stock

The Amplex Div of Chrysler Corp 6500 Harper Ave Detroit Mich has made available Oilite self-lubricating bearing material in cored and solid bar stock as well as plate and



sheet stock In this form it serves a definite purpose in industry in that it allows for the installation of an Oilite bearing in emergencies

Cored bars are 6½ in long and are available in various inside and outside diameters Sufficient material is left on both these surfaces to allow for suitable machining which is done very easily following usual machining procedure This is also true of the solid bars

These new stock sizes are of the same "Oilite" as has been available in sheet and plate form previously This material is an oil cushion bronze thoroughly impregnated with a good grade of lubricant to the extent of 35 per cent by volume Since the material is porous the self-contained oil provides a high factor of safety and assures long life and smooth operation Pore structure of the bronze is not destroyed or harmed by machining

Hammered Metal Effects Produced by New Finish

Finishes resembling hammered silver, copper, bronze, and other ornamental metals can be applied to products made of any kind of metal and plastics by "Hammertone" finish, developed by Maas & Waldstein Co., 438 Riverside Ave., Newark, N. J.

In finishing a surface, a base coat of the desired color is first sprayed on. This is followed immediately by a spatter coat of "Hammertone" liquid, which produces the hammered pattern in the base coat. The product is then baked at medium heat for an hour, which produces a lustrous metallic finish that is tough and durable. By using a special form of spray gun perfected by Maas & Waldstein for the spatter coat, even an inexperienced sprayer can produce any desired hammered pattern and maintain it uniformly.

"Hammertone" is claimed to be an excellent finish for metal novelties, heating units, air-conditioning equipment, metal cabinets and furniture, plastic radio cases, and other similar products. Speed and ease with which it can be applied adapt it for continuous production methods.

TRADE PUBLICATIONS

ACCIDENTS National Safety Council, Chicago, Ill., has issued its annual statistical report for 1939 on accidents in the metal products industry.

BENDING MACHINES American Pipe Bending Machine Co., Boston, Mass., offers a 3-page folder which gives a brief description of three sizes of motor-power operated machines with bending equipment.

BRAKES Stearns Magnetic Mfg. Co., Milwaukee, Wis., has issued a 12-page bulletin No. 604, which provides a complete description, specifications, formulas and installation views on the subject of magnetic disc brakes.

BURNISHING MATERIALS H. Leroy Beaver, Lansdale, Pa., offers four-two-page leaflets which provide information regarding burnishing materials.

CONVEYORS Metzgar Co., Grand Rapids, Mich., offers a three-page folder which describes the application of wheeled conveying systems.

FAN WHEELS A new 80-page catalog which illustrates a complete line of fan wheels, and which provides many performance charts and tables showing the capacities of the different size fans, is being circulated by Advance Aluminum Castings Corp., Chicago, Ill.

MILLING, HOBBING MACHINES Lees-Bradner Co., Cleveland, has published a 16-page booklet which illustrates and describes various milling, hobbing and grinding machines.

OIL COOLERS Catalog No. 31 circulated by Condenser Service & Engineering Co., Hoboken, N. J., describes the uses and design of lubricating oil coolers.

PLUGS Pile-National Co., Chicago, Ill., offers Bulletin No. 114-2 which lists prices and sizes of plugs and receptacles.

PRE-FINISHED METALS American Nickeloid Co., Peru, Ill., has issued a series of five small folders which indicate how the use of pre-finished metals will reduce manufacturing costs.

PRESSES Clering Machine Corp., Chicago, Ill., presents a brochure which describes applications, operating advantages, design and construction, capacities and size of hydraulic power press equipment

PULLERS Owatonna Tool Co., Owatonna, Minn., has published Bulletin No. G-3-40, which lists prices and provides operating details of Grip-O-Matic pullers.

SHELL HOLDERS Logansport Machine, Inc., Logansport, Ind., has issued a new bulletin which describes air and hydraulic operated shell holding equipment.

STARTERS Trumbull Electric Mfg. Co., Plainville, Conn., is distributing circular No. 322 which illustrates and explains the features of its entire line of magnetic starters.

STEEL Republic Steel Corp., Cleveland, Ohio, has released a 4-page folder which contains tabulated data of the analyses and properties of 13 of the most popular types of Enduro stainless steel.

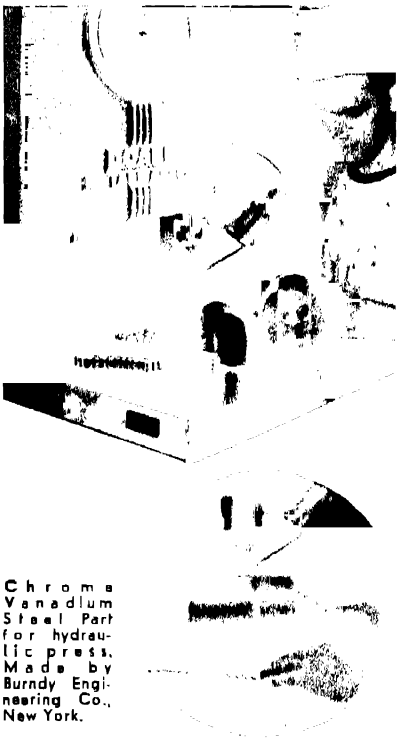
SWITCHBOARD INSTRUMENTS Catalog No. 43-205 circulated from Department 7-N-20, Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa., describes the construction and operating principles of rectangular case switchboard instruments.

VALVES Homestead Valve Mfg. Co., Coraopolis, Pa., offers a four-page pamphlet which describes and illustrates the construction and operation of valves.

WELDERS A 4-page illustrated leaflet No. 26-325 describing portable a.c. welders is issued by Dept. 7N20, Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

WELDERS A 4-page bulletin No. 51, circulated by Acme Electric Welder

DoALL RELEASES OTHER MACHINE TOOLS ON URGENT DEFENSE JOBS



Chrome Vanadium Steel Part for hydraulic press. Made by Burndy Engineering Co., New York.

Former Milling time 13 hours
The DoAll removed sections shown in 37 minutes, reducing the finish milling to 2 hours

DoAll Savings on Milling...11 hours

The DoAll offers important short cuts in stepping up production. A great time and energy saver in cutting out internal and external shapes from any metal up to 10" thick.

Eliminates long hours of tedious hand work in making special tools and dies and in turning out short runs of metal parts.

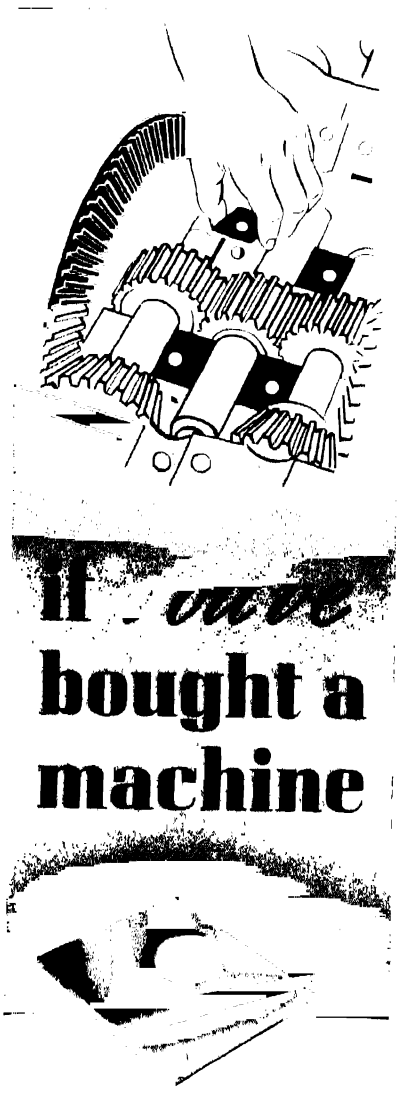
This rugged precision machine tool is creating a sensation in 30 countries—in metal working plants, machine shops, arsenals, airplane factories, ship yards, etc.

Let a factory trained man bring a DoAll to your plant and show you what it can save on your own work.

FREE—New Handbook on Contour Machining—158 pages of valuable metal working helps.

CONTINENTAL MACHINES, INC.
1310 S. Washington Ave., Minneapolis, Minn.

☐ Send data on the DoAll AM-10
☐ Send free Handbook
Name
Address



Probably Laminum shims are standard equipment on your new purchase. If not, when you service it use Laminum for quick adjustments of bearings and fitted mechanical parts. It pays! Simply *peel* off .002 or .003 inch brass laminations. For *precision* adjustment! • *Shims cut to your specifications . . . stock shim materials are sold by mill supply distributors.*

Laminated Shim Co., Inc.
50 Union St., Glenbrook, Conn.

Write for file-folder of shim application photos—with Laminum sample.

LAMINUM

THE SOLID SHIM THAT PEELS FOR ADJUSTMENT

A-1170

Co., Huntington Park, Calif., describes the advantages of foot-operated spot welders.

WINCHES Stephens-Adamson Mfg. Co., Aurora, Ill., provides bulletin No. 340 which describes a complete line of hand and motor winches.

NEW BOOKS

LIGHTING AND AIR CONDITIONING—*Production Series Booklet No 118, published by American Management Association, 330 W. 32nd St., New York, N. Y. $0.75.*

Containing many practical recommendations as to proper applications of lighting and air conditioning in the modern plant, this booklet contains articles by W. C. Brown, illuminating engineer, General Electric Company; A. E. Stacey, Jr., Buensod-Stacey Air Conditioning, Inc.; and William B. Henderson, Air Conditioning Manufacturers' Association. Much of the data is tabulated Line drawings and photographs are used to illustrate many of the principal points brought out in the discussion

•

BETTER FACTORY DESIGN—*Production Series Booklet No. 117, published by American Management Association, 330 W. 42nd St., New York, N. Y. $1.*

Containing sections by Raymond S. Perry, Ingersoll Milling Machine Co.; Albert Kahn, Albert Kahn, Inc.; H. K. Ferguson, The H. K. Ferguson Company; W. J. Austin, The Austin Company; L. J. Jordan, Industrial Rayon Corporation; R. D. Frick, Campana Corporation; and Stanley M. Brown, Hygrade Sylvania Corporation, this booklet entitled "Lowering Costs Through Better Factory Design" should be of interest to presidents of companies, general managers, and plant engineers, throughout industry. The authors collectively have a very wide experience in the design and maintenance of factory buildings and, from their experience, have incorporated in this booklet a number of valuable suggestions.

•

PRACTICAL MECHANICS AND STRENGTH OF MATERIALS. *Third Edition. By Charles Wilbur Leigh, B. S., professor emeritus of analytic mechanics, Armour Institute of Technology, and John Frederic Mangold, associate professor of mechanics, Armour Institute of Technology. 498 pages. McGraw-Hill Book Company, 330 West 42nd St., New York, N. Y. $3.00.*

This volume, as the title suggests, presents those principles of mechanics and strength of materials which the authors believe essential for the practical man. The aim throughout has been to develop the material as one continuous subject, rather than as two separate ones. Each chapter on strength of materials is preceded by those principles of mechanics necessary for its presentation.

The book is intended for night schools, vocational schools, colleges desiring a short course in mechanics, and for men engaged in practical construction work. It is not a course in design. So far as the mathematical requirements are concerned, the student who has a working knowledge of algebra, geometry and trigonometry will have no trouble in reading it.

Formulas for estimating strength of machine parts are included, and are illustrated by numerous problems. Both graphic and algebraic methods of solution are presented at the same time.

In the third edition a large amount of material has been added to the previous edition to enlarge the scope and effectiveness of the text. All lists of problems are new.

•

FIRE—*Published by Harold Joe Davis, 3927 E. Admiral Place, Tulsa, Okla. $0.25.*

This 14-page booklet discusses the cause, prevention and control of fire, which destroys more than $300,000,000 worth of property in the United States each year. The author points out that while fires occur under conditions that vary greatly, the basic cause of fire is the same. Fire can exist only if three elements are present: (1) something to burn, (2) a form of active energy or heat, and (3) the proper mixture of air. Without a combination of all three of these, a fire cannot exist.

An important part of this booklet is a discussion of the four classes of fires, and successful agents used for extinguishing each type.

•

SIMPLE BLUEPRINT READING WITH SPECIAL REFERENCE TO WELDING—*138 pages. Published by the Lincoln Electric Company, Cleveland, Ohio. 50 cents in the U.S.A., 75 cents elsewhere.*

In view of the need of training so many beginners for the various branches of the metal-working industry this little book should come in very handy. While primarily intended for the welder, the principles pointed out in it are of value to anyone concerned with mechanical construction.

A simple approach is used, starting with a picture of a simple welded object and showing how it can be presented as a perspective drawing, an isometric drawing and an orthographic projection. The various conventions commonly used in drafting, such as broken views, omitted parts, dotted lines, dimensions and methods of indicating type of weld are described. In short, the book affords a sound treatment of the fundamentals.

AMERICAN MACHINIST

October 16, 1940



Turn on the Heat—*Manufacturers under pressure to speed up armament output turn to heat-treating and welding to improve their products*

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how

TO USE THIS ISSUE

IF YOU'RE GOING TO THE SHOW:

1. Read through the Show-in-Print section in detail, checking those items which you want to see and noting any questions in margins.
2. Check booths you intend to visit in the List of Exhibitors.
3. Use this issue as a preview and guide to the Show.

IF YOU'RE NOT GOING TO THE SHOW:

1. Look through the Show-in-Print—there may be so many items you want to know more about that you'll decide to go.
2. Check advertising pages for further detail.
3. Keep the issue as your permanent record of the Show.

IN EITHER CASE:

1. Read the special section on sheet steel—then mark it for filing.
2. Note carefully the record of new heat-treating and welding processes. Can you adopt—or adapt—any of the ideas pictured?
3. Preserve the issue as a working handbook—showing methods in the editorial pages, equipment and supplies in advertising pages.

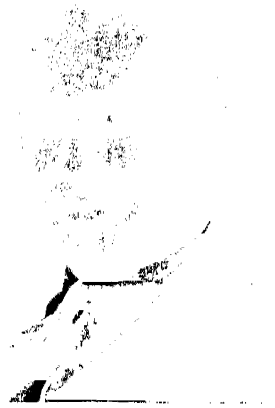
THE ANNUAL METAL SHOW NUMBER of AMERICAN MACHINIST

WHAT'S IN THIS ISSUE

American Society for Metals



JAMES P. GILL



OSCAR E. HARDER

American Welding Society



GEORGE T HORTON



COL. G. F. JENKS

CAN YOU AFFORD . . ?

The other night we were waylaid by an enterprising automobile sales man He had mistakenly assumed we were planning to part with our old jalopy and some $750 for a longer, wider, roomier, heavier, shinier, snappier new car (Name on re quest) After appealing to every buy ing urge from personal pride to passionate patriotism, he finally got around to the classic argument, "you can't afford *not* to buy a new car!" Being a mere engineer, and not a salesman, we were stopped by that one, so we retired to our hideout to wrestle with the dollars and cents

The net result was that we still couldn't figure why it would be cheaper to haul around 3600 pounds instead of 2700, or how we could save money feeding eight cylinders instead of six

This all leads up to the fact that we are as acutely aware as anyone that the old sales gag, "You can't afford *not* to ' is often just so much hot air But we sincerely feel, engineering background and all, that there isn't any catch when we say you can't afford not to visit the Metal Show

But we realize only too well, what with the press of expansion and de fense work, lots of folks won't be able to take in the show this year So we've prepared a preview of all the *new* equipment to be displayed in Cleveland You'll find it described and illustrated in the special "Show-in-Print" section which begins on page 794.

WHO'S WHO

If you're going to the show the list on page 807 should prove a big help It tells who is exhibiting, what will be on display, and which booth number is which

HEAT-TREATING FOR PEACE

Despite the fact that this issue is devoted entirely to the Metal Show, the usual AMERICAN MACHINIST Armament Section is not omitted This one starts off with a pictorial presentation of the part that heat treating plays in national defense Those already working on defense items know that that part is no trivial one, others may be a little sur prised at the vital role it does play in the production of many items For some samples, turn to page 810

UNITED WE STAND

You don't need to be a fifth columnist baiter to appreciate the wisdom of the old motto, 'United we stand, divided we fall" It could be applied with almost equal force to all types of construction—includ ing machine fabrication For the his tory of metal working progress is in a large measure the history of metal uniting techniques Of these none has been more spectacular than the advances made in the art of welding In defense items as well as in other innumerable lines welding serves an important need Examples of its con tribution to U S security begin on page 818

STEELING THE SHOW

No, not a typographical error, but only to lead the conversation around to the special section on the working of carbon sheet steel Since you're already familiar with these materials sections, the only thing we can tell you about is that it begins on page 825—yes, the blue paper

PRESENTING THE PRESIDENTS

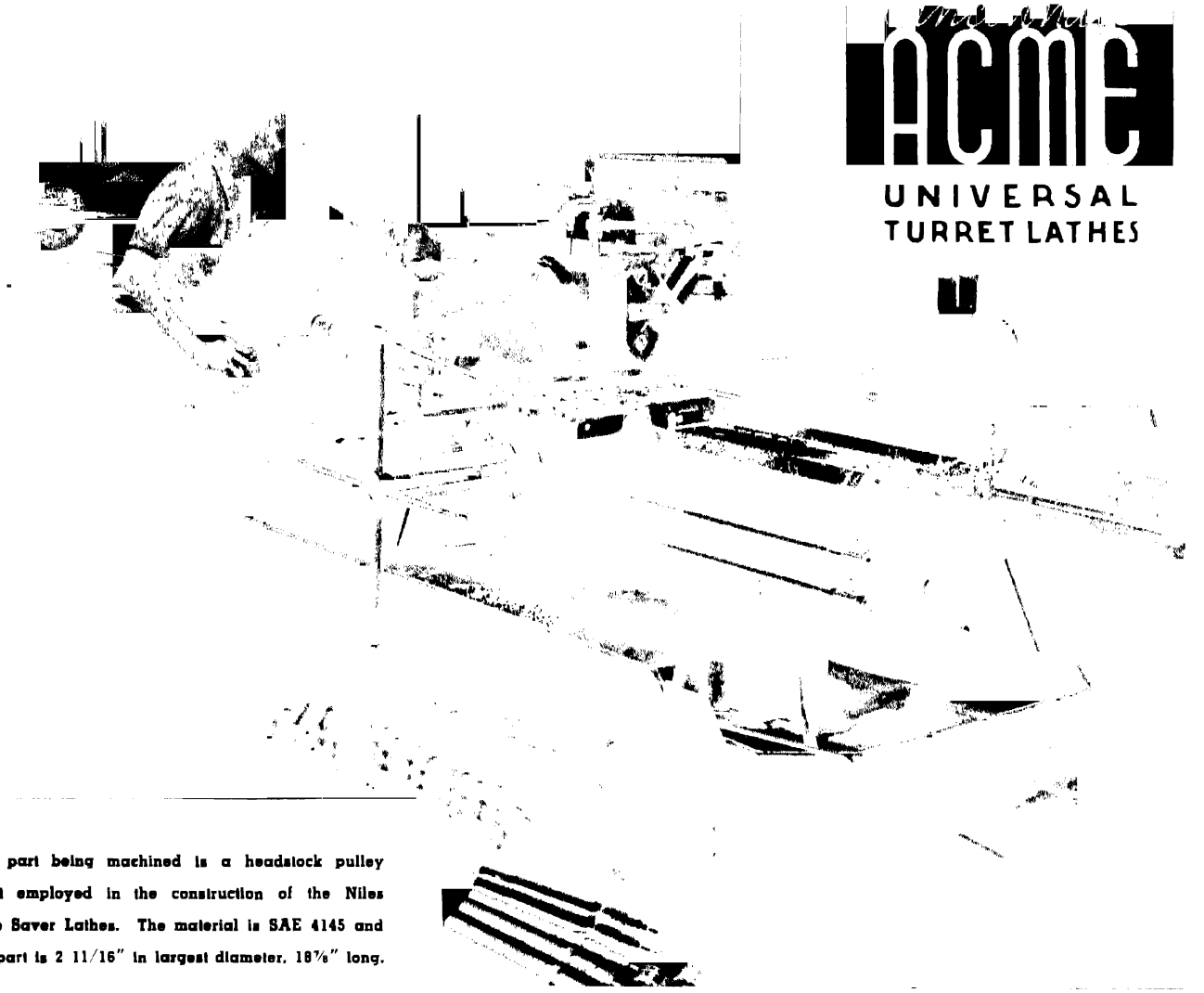
The National Metal Congress & Exposition, as it's officially called, is largely the result of efforts of the leading metal societies, staged every year by William H Eisenman, secretary of the A S M Cooperating closely with Mr Eisenman are the society heads, several of whom we present herewith James P Gill, of Vanadium Alloys Steel Corp, has served for the past year as president of the American Society for Metals, while George T Horton has held the same office in the American Welding Society They will be succeeded by Oscar E Harder, Battelle Memorial Institute, and Col G F Jenks, Ordnance Department, U S Army

COMING

Next number the Armament Section will again be with us to maintain the pace Also scheduled are the last half of the infra red baking article, the first part of a series on truing grinding wheels, a story on welded riveted hopper cars, and others

ACME

UNIVERSAL
TURRET LATHES



The part being machined is a headstock pulley shaft employed in the construction of the Niles Time Saver Lathes. The material is SAE 4145 and the part is 2 11/16" in largest diameter, 18⅞" long.

22% SAVED IN TIME . .

FOR THE NILES TOOL WORK.

This CINCINNATI ACME Universal Turret Lathe—one of two recentl installed in the plant of Niles Tool Works, Division of General Machiner Corporation, Hamilton, Ohio—is speeding up the production of Niles Tim Saver Lathes.

To quote from a report recently received from this plant: "We have checke the savings in time on the new machine (a No. 2, 3½" bar capacity Cir cinnati Acme) and find the savings amount to approximately 22%."

Many other machine tool builders and manufacturers have chosen Cir cinnati Acme Universal Turret Lathes to handle high production an maintain accuracy under closely held tolerances. Operating convenienc versatility and ability to take advantage of fast cutting carbide and simile tools are a few of the many reasons why Cincinnati Acmes play a important part in modernization programs.

Consult our engineers on any problem involving turret lathe production.

MACHINE TOOL CO.

Metals for Defense

REAMS have been written about the difficult job of tooling up for manufacture of munitions. Somehow the part played by the machinist is magnified until it dominates everything. While admittedly his activities are of primary importance, attention should be given the welder, the heat-treater and the metal finisher too.

That is why the National Metal Show comes at an opportune time. The armament production program cannot succeed unless all operating elements are under complete control and are functioning effectively. The more widely used the latest technique in welding, heat-treating and finishing (as well as machining), the more successful the program and the higher the output.

To be specific, heat-treatment of shell presents no major problem so long as furnaces of modern design are employed. The lessons learned in mass-production heat-treating in the automobile industry the past decade will serve well in armament manufacture. Such developments as gas atmosphere furnaces, determination of proper time factors in heat-treatment, skin carburizing, design of conveyorized furnaces, and time quenching have already been worked out in connection with high-production heat-treatment and can be applied without extended experimentation to armament production.

Problems common in shell manufacture during the last war will not be so troublesome in the months ahead, because steel mills long ago learned how to make better steel economically. Production of alloy steels has been mastered. Porosity and piping no longer are common defects of steel. Welding will be more extensively used than ever before, particularly in the assembly of various structures on a mass basis.

Much of the available experience of industry pertaining to welding, heat-treatment and metal-working in the defense program is outlined in the following editorial pages. For the visitor to the Show, the Show-in-Print Section will be a guide and a record. For the non-visitor it will tell what he would have seen had he attended. The special Armament Section is narrowed down to heat-treating and welding for defense production.

SHOW IN PRINT

New and improved equipment, accessories and materials on display at the National Metal Show in Cleveland, October 21-25

LINDBERG "CYCLONE" ELECTRIC TEMPERING FURNACE



The "Cyclone" forced circulation box type electric tempering furnace developed by Lindberg Engineering Co., 221 N. Laflin St., Chicago, Ill., is of particular value in the heat-treatment of parts for the aircraft industry. These furnaces utilize a principle by which large volumes of accurately heated air are driven through the work under pressure and at velocities around two miles a minute. As a result heating is rapid, and every part of the charge is heated to the same temperature.

These furnaces are built in two types—the Toolroom model used for tempering, heating and preheating tools, dies and other small parts; and the Production box type, illustrated, built in larger sizes than the Toolroom type to accommodate heavy production loads such as large gears, forgings and aluminum and ferrous aircraft parts. In the Toolroom model, removable open grate shelves are provided, permitting easy passage of heated air through the charge. The Production type is normally supplied with a heavy cast grid on which the work can be loaded; however, sliding grids can be supplied as well as special handling means.

Door of the Toolroom model is of the plug type, while that for the Production model is of the counterweighted vertical lift type. Air-operated doors can be supplied. Heating elements are made of high grade nickel chromium wire wound into coils. Standard temperature ranges are from 200 to 850 F. for the Toolroom model and from 200 to 1,250 F. for the Production model. Four sizes of the Toolroom model and five sizes of the Production model are available.

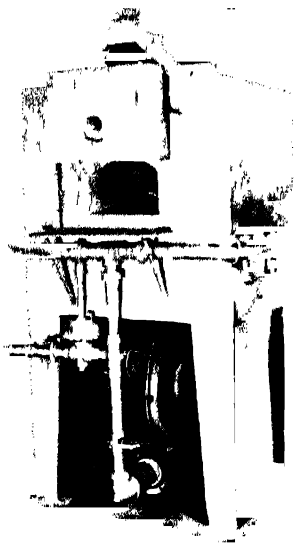
AJAX ELECTRIC SALT BATH FURNACE



Two entirely new applications for salt baths—brazing and heating for forging—are possible with the "Ajax-Hulgren" electric salt bath furnace made by Ajax Electric Co., Frankford Ave. & Allen St., Philadelphia, Pa. No heating elements are used in this furnace. Electrodes are closely spaced and placed at one side of the machine, out of the work-treating region, the electromagnetic forces providing constant forced circulation of the salt bath and insuring uniform temperature throughout.

Several advantages are claimed through the use of the electric resistance method of heating. A considerable saving of fuel cost results, since heat is released directly in the salt bath. Pot life is greatly extended since there is no flame impingement on outside walls. Greater uniformity of product is made possible by the automatic stirring action of the bath and by the fact that no current from the electrodes passes through the work to cause local overheating. Excessive salt decomposition is eliminated, thereby removing the difficulty of keeping the bath at the proper chemical balance. Flexibility of design is possible.

This type of furnace can also be used for carburizing, cyaniding, scale-free hardening, tempering, annealing and hardening of many types of steel articles. It is also applicable for the treating of aluminum alloy parts for the aircraft industry.



MAHR TOOL FURNACE

Mahr Mfg Co, Div of Diamond Iron Works, Inc, Minneapolis, Minn, has developed a tool furnace especially to meet the demands for a low cost furnace having positive combustion control The combustion chamber is designed to give uniform heat throughout the hearth area at any temperature desired for any treatment of the various steels

A special proportional air gas mixer has a vernier control graduated for easy and quick setting The operator can make a temperature chart of adjustments He can also chart any number of specific processes for treatment of the various classes of material The ratio can then be changed to either oxidizing or reducing at positive settings by movement of the vernier control The record chart permits instant repeat settings for future operations

This 12x18x6 in gas underfired furnace is equipped with four premixed gas burners arranged for single valve control It has a graduated blast gate for primary setting to adjust for any class or grade of gas It is lined with special quality refractory to give long service life Frame is of all welded steel construction It can be furnished with or without blower

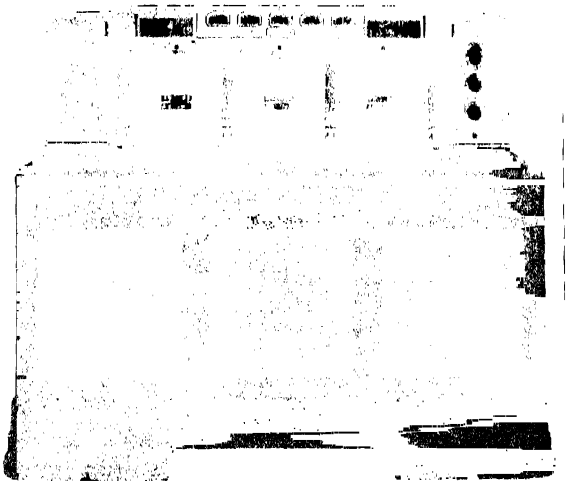
OHIO CRANKSHAFT "TOCCO JR." INDUCTION HARDENER

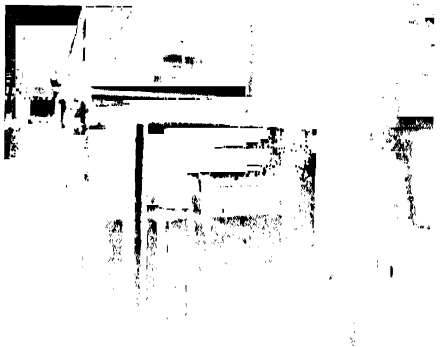
Available in capacities of 10, 20, 40, 60 and 80 kva, the Type MG 10 Tocco Jr induction hardening machine has been developed by Ohio Crankshaft Co, 6600 Clement Ave, Cleveland, Ohio, especially for the surface hardening of many small parts with the use of simple fixtures Powered with self contained 9,600 cycle generators these machines can be furnished with one two or three hardening stations Any or all stations may be equipped with automatic feeding and handling devices

Machine is versatile compact and economical It does not require a skilled operator A replica of the large units except that it has all been put into a single package which can be placed in the production line it can be easily moved from place to place as manufacturing changes demand

Unit is furnished complete with a motor generator set for supplying high-frequency current to the induction heating device a panel with complete instruments which indicate all essential control factors, an iron core water cooled transformer, a high frequency circuit breaker which is the main switch between the generator and the inductor, and automatic cycle control With this control the push of a button starts the cycle The circuit breaker is closed and held closed for the predetermined time and the electrically operated quench valve is opened and held open for the predetermined time to produce an exact hardening cycle which is controlled within a fraction of a second This eliminates the human element and insures absolute duplication of hardening cycles

A sturdily built cabinet houses all equipment Two high-capacity fans pull air through filters over the motor generator and other parts to insure proper cooling with clean air Cabinet is provided with a drain pan





WESTINGHOUSE ELECTRIC FURNACE

Increased production and fewer rejections are claimed for an electric furnace for bright hardening high carbon and alloy steel airplane motor parts, developed by Westinghouse Electric & Mfg Co, East Pittsburgh, Pa A continually moving belt conveyor in the furnace passes through an inert gaseous mixture known as Endogas, which prevents decarburization This gas an inexpensive atmosphere produced by a special reaction with ordinary city gas can be used to harden any SAE steel without decarburization Parts are discharged directly from the controlled atmosphere heating chamber into the quenching bath.

DESPATCH "CONTROLLED COMBUSTION" FURNACE



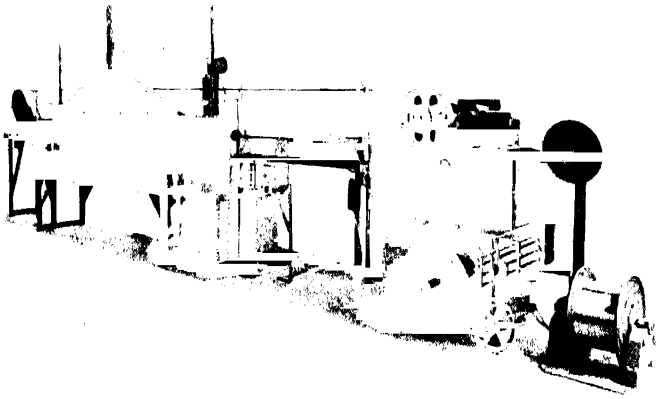
Despatch Oven Co., Minneapolis, Minn., has developed a forced-draft furnace having "controlled combustion," a new feature to assure the best gas consumption possible with an atmospheric type burner under all operating conditions. With "controlled combustion," the user is said to get more heat from the gas burned, and to get the heat into the furnace faster.

These furnaces are made in four standard sizes, and can be made in any special size to meet any particular requirement. They are available in two temperature ranges—one up to 850 F. and the other up to 1250 F.

SURFACE COMBUSTION "SYNCRO" ANNEALING UNIT

Developed jointly by Surface Combustion Corp., Toledo, Ohio, and Syncro Machine Co., 420 Lexington Ave., New York, N. Y., the "Syncro" open flame annealing and tinning unit has been especially built for high-speed tinning and annealing for the wire industry.

Standard machine is a six-strand unit, and machines can be furnished to accommodate any number of strands up to twenty. A visual indicator constantly shows degree of anneal taking place in each strand. A push-pull capstan controls the wire lines through the furnace, assuring proper tension and limiting the area reduction of the annealed wire to less than ½ of 1 per cent. Annealing furnace is of the direct flame, gas fired type, to provide economical, efficient and properly controlled heating. A chlorine fluxing agent rapidly and thoroughly cleans the wire prior to tinning. An advanced design of tin applier uniformly coats the wire. Tin is entirely inclosed under controlled atmosphere to minimize oxidation losses. A self-cleaning wiping device retrieves excess tin from the wire and burnishes it to a high lustre as it leaves the tinning zone.



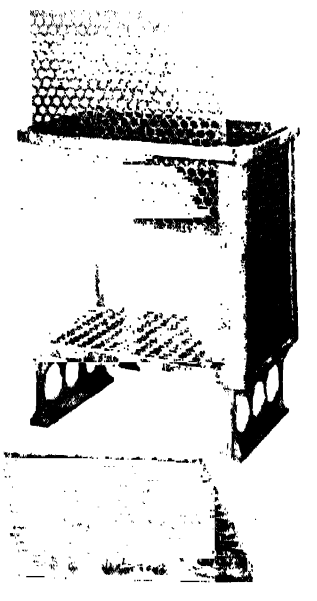
Quenching takes place in circulating water, and moisture is removed by an efficient vacuum wiper. Take-up is motor driven with wire tension control with a special magnetic slip clutch which also controls the traverse. Spool drive automatically maintains tension at which it is set throughout the filling of an entire spool, and this tension can be adjusted while the machine is in operation. Annealing units are available for installation ahead of enameling units to increase efficiency and improve quality by annealing and enameling wire in one operation.

JOHNS-MANVILLE "L-W SUPEREX" INSULATION

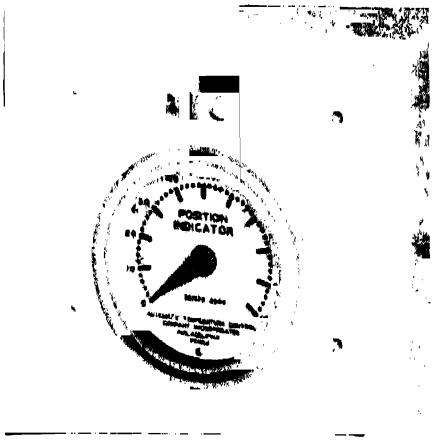
A 1,500-deg. insulating material, "L-W Superex," has been introduced by Johns-Manville, 22 East 40th St., New York, N. Y., to provide improved insulation and strength characteristics. Furnished in both block and pipe covering form, this material is suitable for use in industrial furnaces, ovens, kilns and other applications where the insulation will be subjected to temperatures between 600 and 1,500 F.

The insulation is of the molded diatomaceous silica type, weighing only 20 lb. per cu. ft. Blocks are furnished 3, 6, 9 and 12 in. wide in standard lengths of 18 and 36 in., in thicknesses from 1 to 4 in. Pipe insulation fits standard pipe sizes.

DRIVER-HARRIS "NICHROME" NORMALIZING BASKET



Among the recent developments of the Driver-Harris Co., Harrison, N. J., is a "Nichrome" (60 per cent nickel–13 per cent chromium) normalizing basket which has been specially produced for the heat-treatment of Garand rifle barrels. This basket consists of a cast "Nichrome" bottom, perforated sheet "Nichrome" slides, and hot rolled "Nichrome" wire and strip.



A.T.C. POSITION INDICATION SYSTEM

Automatic Temperature Control Co., 34 E Logan St, Philadelphia, Pa., has made available a position indicator which operates on the Wheatstone Bridge principle and employs a patented rugged galvanometer relay. A small potentiometer type rheostat is mounted on or near the body whose position is to be indicated and mechanically connected to this body by gears, links, sprockets or other convenient means. Upon any change in the body's position, the indicator follows immediately and registers the change on its large, easily read dial. Unlike other methods of remote position indication, the indicator cannot get out of step with the transmitter or change its pointer's position in case of power failure. There is virtually no limit to the distance between the transmitter at the moving body and the position indicator itself. Hand operated transmitters may be used to give orders, values or information from a remote point.

PYROMETER INSTRUMENT "PYRO" PYROMETER

Pyrometer Instrument Co., 103 Lafayette St., New York, N. Y. has developed two new optical pyrometers for accurate determination of high temperatures.

The Bi-Optical pyrometer, illustrated, a totally self contained direct reading instrument, permits accurate temperature measurement without uncertain correction coefficients by simultaneous measurement of black body and actual or color temperatures. It employs light filters and color wedges which are transparent to a number of colors simultaneously. By using filters with a number of transparencies both for separation and for mixing and toning down any complicated optical or mechanical device for the combination of colors rendered superfluous and the creation of a simple temperature measuring device in the form of colored disks is made possible. The instrument is furnished with scale ranges from 950 to 2,000 C., or from 1,800 to 3,600 F.

The Micro-Optical pyrometer is a precision instrument for measuring at close range the temperatures of very small objects such as incandescent lamp filaments, and for laboratory and scientific research work. A 20-fold magnification of the object is provided by an efficient optical system. A precision ammeter with built-in battery is attached to the instrument, which operates on the principle of the disappearing filament. It is furnished with scale ranges of 600 to 1,600 C., 1,600 to 3,000 C., and 3,000 to 4,000 C. and equivalent F. ranges.



GENERAL ELECTRIC "DRYCOLENE" HEAT-TREATING GAS

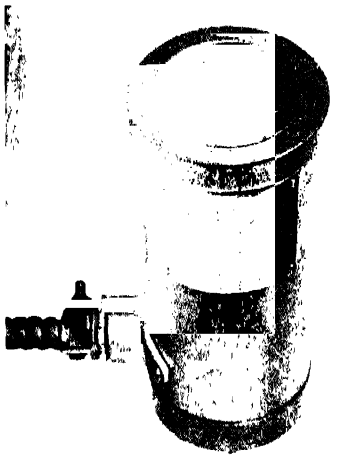
Drycolene, an atmosphere gas for heat-treating steels without surface decarburization, has been developed by General Electric Co., Schenectady, N. Y. This gas makes possible such operations as scale-free hardening, bright annealing, sintering and electric furnace brazing of high-carbon steels where surface decarburization, carburization or oxidation cannot be permitted.

The Drycolene producer is a gas-heated vertical cylindrical furnace containing an alloy retort filled with charcoal. It consumes hydrocarbon gases and heats the charcoal in the retort to a high temperature. The products of combustion are cooled to remove moisture, and then passed through the incandescent charcoal. The effluent gas, Drycolene," which consists largely of carbon monoxide and nitrogen and is completely free of carbon dioxide, water and oxygen, is then ready to be delivered to the furnace without further treatment.



ARMSTRONG EASILY IDENTIFIED FIRE BRICK

Armstrong Cork Co., Lancaster, Pa. has introduced a system of color spots to identify the four types of high temperature insulating fire brick now in production. These spots supplementing the regular brand stencil, provide easy and permanent identification, and minimize the possibility of error on the part of brick masons even when the stenciled name is hard to read. The distinctive color of Armstrong's fifth type of fire brick—N-16—establishes easily recognizable identity of this type without the use of a color spot.



BROWN "RADIAMATIC" PYROMETER

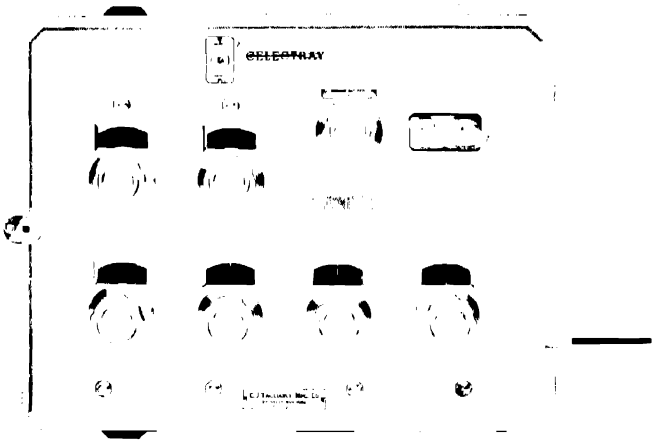
Brown Instrument Co. Div. of Minneapolis-Honeywell Regulator Co., Philadelphia, Pa., has developed a "Radiamatic" pyrometer for the measurement and control of temperature in applications where thermocouples are impractical or unreliable. This pyrometer is designed to operate under the severest service conditions.

Completely self-contained and compensated for ambient temperature errors, the "Radiamatic" detector is sighted on the hot object, moving or still, and continuously measures the temperature of the material itself. Heat radiated from the hot object is focused on a thermopile which generates an e.m.f. proportional to the true temperature. Desired e.m.f. alone is continuously indicated or recorded by the potentiometer.

The pyrometer is built to withstand vibration, dust, dirt, fumes and corrosive atmospheres. Easily installed, it is recommended where vibration is present.

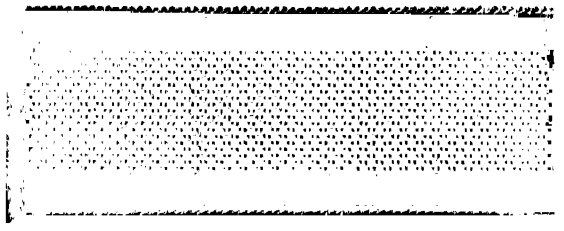
TAGLIABUE "CELECTRAY" INDICATOR

The "Celectray" self-balancing multiple-point indicator has been developed by C. J. Tagliabue Mfg. Co., Park & Nostrand Aves., Brooklyn, N. Y., especially for taking a great many temperature readings in a minimum time without personal errors resulting from fatigue. With the fastest model, readings can be taken every few seconds. A hairline indicator designed to minimize parallax increases readability. This, combined with precision balancing, provides an accuracy generally superior to hand balancing of portable potentiometers. An "in balance" signal is provided which lights while the indicating carriage is traveling from one point to the next, flickers while it steps into accurate balance, and stays out when it is time to take the next reading. If more than twelve points are required a separate switch box of the same design as the instrument case can be supplied for an almost unlimited number of points. A special arrangement of internal scale lighting can also be furnished.



CAMBRIDGE DUPLEX SELVAGE WIRE BELT

Cambridge Wire Cloth Co., Cambridge, Md., has developed a duplex selvage wire belt which is claimed to reduce operating cost on furnaces for copper brazing, normalizing, carburizing, hardening, bright annealing, silver soldering, spring tempering, and other heat treating operations. This double selvage adds extra hours of service and offers freedom from operating difficulties by providing double strength at the point of greatest wear. Belts are available in a variety of meshes and wire gage combinations. They can be obtained in various alloys for operation in temperatures up to 2,100 F.

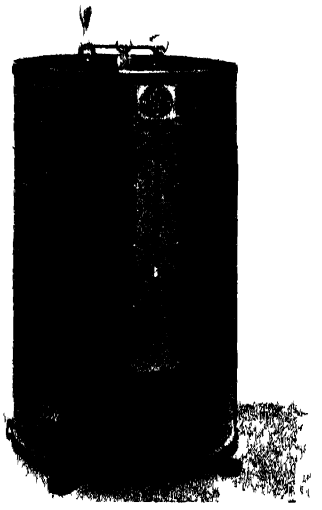


"AMPCO-WELD" ALUMINUM-BRONZE WELDING ROD

Ampco Metal, Inc., 3830 W. Burnham St., Milwaukee, Wis., has developed a versatile aluminum-bronze welding rod which meets the demand for a more readily handled rod and for stronger and longer-wearing welds. Known as "Ampco-Weld," this rod provides a weld metal having good bearing qualities, wear resistance, high fatigue strength and high impact strength.

In addition to operating efficiently and economically in repair work, the new rod can be employed in coating surfaces of large forming dies and other pieces of equipment to obtain longer die life and freedom from galling and scratching. In other large applications requiring a corrosion-resistant metal the foundation may be built up from cast iron or steel and then overlaid with this material, thereby reducing cost.

GENERAL ELECTRIC HIGH POWER FACTOR WELDER

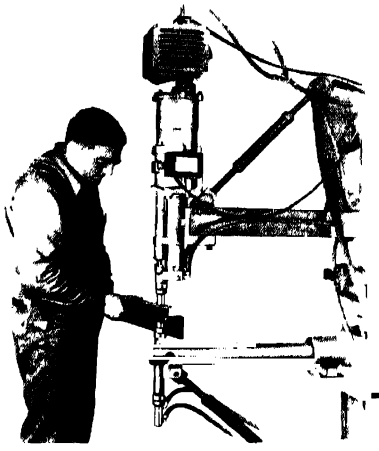


General Electric Co., Schenectady, N. Y., has announced a line of 300 amp a c arc welders offering advantages in performance and economy resulting from an electrical design which incorporates power factor correction. This built-in feature practically eliminates the useless lagging current drawn by conventional designs. Hence, smaller primary cables, line switches and fuses can be used. This often results in a saving on installation costs and makes possible the addition of more welders to existing feeders without overloading.

When operated below half load, this welder provides leading reactive kva for improvement of shop power factor. When operated at no load, there is 10.0 kva available for this purpose.

Other advantages include finger tip adjustment, a large easily read current indicator, protected output terminals accessible through holes in the insulating panel, and fan forced ventilation, providing cool dependable operation even at high currents or high duty cycles. The welder is only 43 in. high and 21 in. in diameter. Net weight is 450 lb.

PROGRESSIVE "FORGE-WELDING" PROCESS



Forge Welding is a process of heavy-duty electric resistance welding for joining heavy ferrous sections heretofore considered impossible to weld with conventional equipment, developed by Progressive Welder Co., 3001 E. Outer Drive, Detroit, Mich. By this process, it is claimed that heavy work can be welded almost as easily and rapidly as spot welding sheet metal.

The process consists of first applying pressure to the work, then an interrupted current, and finally superimposing a hammering action on the electrode. Under high pressures and temperatures, work surfaces are brought into such intimate contact that when additional impact pressure and intermittent heat are applied a superior quality forged weld is obtained.

To secure the forging effect while holding the work under pressure a compound-action Hydro-Booster is used. Other special equipment required is of the accessory type, such as an automatic timer to control sequence of operations, and heat and pressure resistant alloy electrodes.

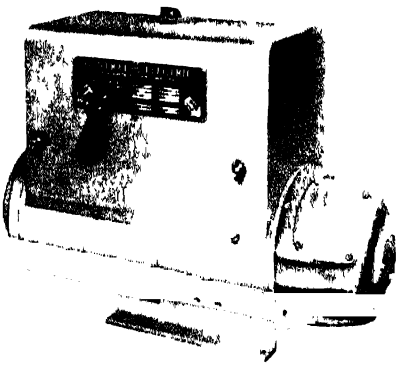
Spot size varies according to metal and thickness. On work totalling 1½ in. thick the spot will usually be approximately 1 in. in diameter near the surface.

PAGE-ALLEGHENY STAINLESS STEEL WELDING ELECTRODES

Page Steel & Wire Div. of American Chain & Cable Co., Monessen, Pa., offers Page Allegheny stainless steel welding electrodes coated with formula No. 473.22. With this coating, electrodes are claimed to hold an extremely smooth arc with practically no spatter. Deposited metal is extremely fluid when molten, resulting in a very smooth weld surface which is bright and clean.

For gas welding on stainless steel, Page "Hi Tensile M" gas wires are also available. These wires are claimed to give a strong, ductile weld with no air hardening or embrittling, and which will respond excellently to heat treatment.

GENERAL ELECTRIC 25–250-AMP. d.c. ARC WELDER



A d c. arc welder which will provide any welding current from 25 to 250 amp. has been developed by General Electric Co., Schenectady, N. Y. This wide range allows all-day manual welding to be done with currents up to 200 amp. using electrodes from $\frac{1}{16}$ to $\frac{5}{16}$ in. in diameter. Capacity is also provided for use of electrodes as large as ¼ in. on occasional short jobs.

Welder has two outstanding features. First, it provides for instant recovery of voltage to an extent greater than the arc voltage after each short circuit thus preventing time wasting arc popouts. Second, it never allows current peaks to exceed three times the steady short circuit current on any adjustment thus preventing excessive heat and spatter and resulting in a saving of electrodes. Other advantages include self excitation and welding current quick adjustment.

LINDE "OXWELD" BAR CUTTING MACHINE



An oxyacetylene bar-cutting machine designed for a number of steel mill cut-off operations has been developed by Linde Air Products Co, a unit of Union Carbide & Carbon Corp, 30 F 42nd St, New York, N. Y This portable device, known as the Oxweld CM 35 bar-cutting machine, will cut rounds or squares with a minimum of adjustment It is driven by a self-contained spring-power unit, the speed of which is hydraulically controlled

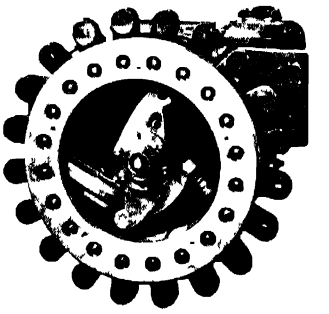
Machine is simple in operation, the correct motion for cutting either rounds or squares being transmitted positively to the blowpipe by an easily adjusted linkage Hydraulic control provides smooth blowpipe travel with an almost infinite variation of cutting speeds between 1 and 75 in per min Self-contained power unit offers the additional advantage of increased portability The machine can be used indoors or out, wherever oxygen and acetylene are available, and can be moved to a new workplace at a moment's notice, since neither electric power nor guide track is necessary With standard equipment it has a cutting range of from 2 to 10 in This range can be changed, however, to 8 to 15 in by special linkage arms which are installed easily

TAYLOR-WINFIELD "ULTRASPEED" WELDER SWITCH

The Ultraspeed rotary type of welder switch developed by Taylor-Winfield Corp, Warren, Ohio, shortens the welding cycle by returning to its starting position by virtue of its circular construction, thereby eliminating reversing motor control necessary on straight-line action devices.

In operation, the motor drives the brush-holder rigging through a worm gear reducer and Geneva motion, thus indexing the brush from one segment to another Welds are made while the brush is stationary on the commutator section, thus eliminating transmission of heavy currents while the brush is moving Main distributor ring, located immediately behind the commutator ring, transmits current to the commutator segments by a brush of laminated silver-plated copper construction A cam-operated limit switch automatically stops the device after one cycle is complete Rotary design eliminates reversing





TAYLOR-WINFIELD "HI-WAVE" SPOT WELDER

The "Hi-Wave welder offered by Taylor-Winfield Corp, Warren, Ohio, is claimed to introduce a radically new system of spot welding Intensive research is said to have resulted in the development of a complete line of equipment for producing spot welds in aluminum alloys of a quality which cannot otherwise be duplicated While it has been developed primarily for welding aluminum alloys, it is applicable to steel, and non-ferrous metals

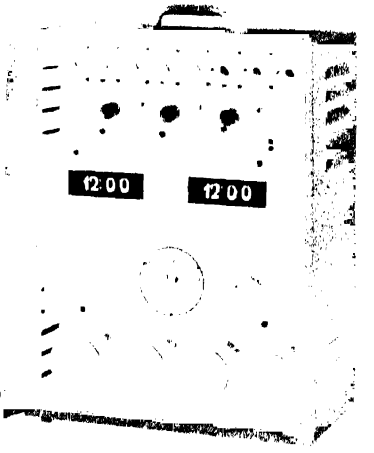


Equipment consists of a conventional type spot welder with an entirely different transformer Principal welder refinement is increased rigidity to prevent any possibility of electrodes skidding during welding Control panel includes a bank of capacitors, charging transformer rectifier, and the necessary relays

In operation, three-phase a c is passed through the transformer and rectifier, charging the capacitor bank When this bank is fully charged, the current is automatically cut off and the machine is ready for discharging across the weld As soon as the points are in contact with the work and full pressure has been developed, relays discharge the capacitors through the welding transformer, generating a secondary current discharge through the work This discharge is a single wave of a few microseconds duration Length, amplitude and shape of the wave which have a marked bearing on weld quality—are predetermined by the control apparatus Since the capacitors are charged with the electrodes separated, no time is lost during the charging cycle

Power demand for this type of equipment is roughly 10 per cent of that of conventional welders Another advantage of the 'Hi-Wave system is comparative freedom from pickup Runs of 500 welds are claimed to be easily made without the necessity for cleaning tips

HARRIS-KINKEAD "MASTER MIND" WELDING CHECKER



On display in the booth of the Harris Calorific Co., Cleveland, Ohio, the electric "Master Mind" has been developed in conjunction with Robert E. Kinkead, consulting engineer, for determining the quality of arc welds while they are being made. It can also be used to check automatically the ability of a welder at the time he is being considered for employment, to serve as an automatic instructor when training new operators, to provide means for definitely checking joint preparation methods, and to supply accurate data for time study work.

The device records how well an operator performs his job while the work is actually in process. Red and green lights on the control instrument and in the head shield indicate weld quality. Recording instruments on certain models permit time study information to be obtained, and enable manufacturers to certify their arc welding on special jobs with close specifications.

WALL COLMONOY HARD-FACING ALLOYS

Wall Colmonoy Corp., 636 Buhl Bldg., Detroit, Mich., has developed three new hard-facing alloys for application with the oxy-acetylene flame. "Colmonoy" No. 4 provides a hardness of approximately 35–40 Rockwell C, with an abrasion resistance suitable for repairing die-casting molds, body draw and forming dies, and various other parts which require abrasion resistance and machinability. "Colmonoy" No. 5 is similar to No. 4, but has a hardness of 45-50 Rockwell C. This alloy is used for pump sleeves, wear rings, plungers and parts which receive considerable combined corrosion and abrasion. It can be machined with tungsten carbide tools.

"Colmonoy" No. 9 combines great hardness and toughness. As applied with the oxy-acetylene flame or as cast, and without heat-treatment, its hardness ranges from 65–68 Rockwell C. Its red hardness is also high, making it suitable for application to tools and dies which must retain hardness at elevated temperatures. The melting point is sufficiently low to permit its application to various tools without danger of coarsening the adjacent grain structure. Since it is an iron base alloy, its use in places where corrosion resistance is necessary is not recommended. It can be used with excellent results for tipping tools.

"MUREX" WELDING ELECTRODES

Metal & Thermit Corp., 120 Broadway, New York, N. Y., has announced several additions to its "Murex" line of electrodes for metallic arc welding.

Heavy coated electrodes are now available for a wide variety of services, including both a.c. and d.c., as well as positioned and non-positioned work, on mild steel and a number of high strength, low alloy steels such as Cor-Ten, Man-Ten, Sil-Ten, Mayori, Republic Double Strength, nickel steels and stainless steels. The outstanding feature of these electrodes is said to be their ability to operate at unusually high amperages with a minimum of spatter, thus speeding welding operations and reducing cleaning costs.



CROWN "ROTO-FINISH" BARREL

A double cylinder "Roto-Finish" barrel has been developed by Crown Rheostat & Supply Co., 1910 Maypole Ave., Chicago, Ill., especially for the new Sturgis "Roto-Finishing" Process, which is a tumbling process for finishing die castings and stamped metal parts of stainless steel, brass, and other similar materials. It is claimed that in many cases a finish equal to that obtained by hand buffing operation can be obtained. One of the main features of the barrel is the ease of loading and unloading of all four compartments.

OAKITE CLEANING COMPOSITIONS

Two more compositions for efficient metal cleaning have been developed by Oakite Products, Inc., 22 Thames St., New York, N. Y. Composition No. 54 B is intended specifically for electro-cleaning polished steel and buffed copper before plating. It is said to completely remove all smut on many different types of work in a single operation, thereby eliminating the necessity of degreasing, presoaking, applying emulsifying solvents, or mechanical scrubbing.

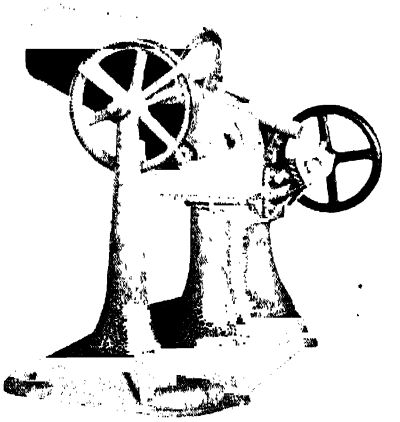
Composition No. 27 is a versatile, heavy-duty cleaning material which, because of its special colloidal and solvent absorption action, its extra wetting ability and improved rinsing qualities, can be used either as a still tank cleaner or as an electro-cleaner. It is also highly suitable for cleaning before vitreous enameling and other coating processes.

GLOBE TILTING TUMBLING BARREL

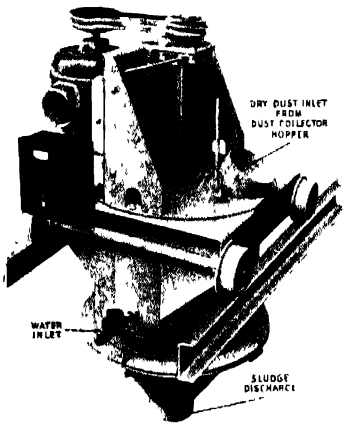
Globe Machine & Stamping Co., 1250 W. 76th St., Cleveland, Ohio, offers a line of motor-driven tilting tumbling barrels for finishing parts difficult to burnish or polish in the usual way. A special work-shifting bottom promotes tumbling action and cuts tumbling time.

Operator does not have to stop the machine and remove a cover for filling, inspecting or emptying. He can remove samples merely by reaching in, and can change the angle at any time to intensify or slacken tumbling action. Thus he can be sure exactly when to stop. He can empty contents into a receptacle merely by turning a handwheel.

These barrels remove burrs, fins, flash, scale, roughness, rust, oil, grease, sand and dirt. They handle such materials as steel, cast iron, aluminum and brass. They finish stampings, castings, forgings, screw machine parts and similar items. Barrels can be furnished with steel, cast iron, cast brass, wood, Monel or stainless steel shells. Of simple, rugged construction, they are available in five sizes.



"AMERICAN" WET DISPOSAL UNIT



The wet disposal unit offered by American Foundry Equipment Co., 581 South Byrkit St., Mishawaka, Ind., is designed for wetting and mixing with water the collected dust discharged from hoppers of cloth filter type or other dry types of dust collectors.

Heretofore dry dust disposal has necessitated more than ordinary care in handling. The wet type dust collector eliminates the disposal problem, but these devices are relatively inefficient in dust collection as compared with a cloth type collector. The combined use of the cloth type collector with the wet disposal unit gives maximum over-all dust collecting efficiency.

The "American" wet disposal unit is a self-contained mixer which receives dry dust from the collector hopper and deposits it near the center of a high-speed mixing disk. At the same time, water or other liquid is discharged at the center of the disk. The speed and shape of the disk cause an instantaneous mixing of the dust and liquid and the mixture flows from the sludge discharge at the bottom of the unit. The amounts of dust and water are constantly under the control of the operator, allowing any mixture desired. The unit will handle dust approximately as fast as the hopper can be unloaded dry.

BRADLEY CLAD STAINLESS WASHFOUNTAINS

Washfountains offered by Bradley Washfountain Co., N. 22nd and W. Michigan Sts., Milwaukee, Wis., which have long been available in stainless steel, are now made in clad stainless. Like the solid stainless units, the bowls of these fountains are one-piece pressings having pedestals of Bonderized mild steel finished in baked enamel to match.

Bowls have an 18-8 stainless steel surface approximately 0.028 in. in thickness bonded to a mild-steel base. Fixtures are available in circular and semi-circular models, 54 and 36 in. in diameter. They afford all the advantages of other washfountains in installation, operation, sanitation and, also, are appreciably lower in first cost than solid stainless fixtures.

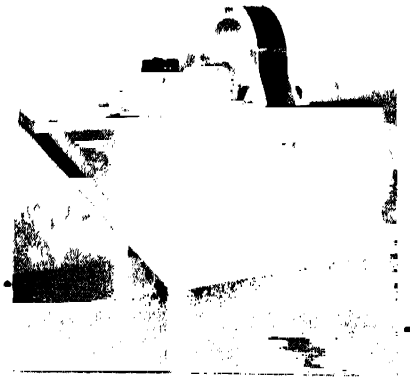
RANSOHOFF DRUM TYPE WASHER AND DRYER

N. Ransohoff, Inc., W. 71st St. at Millcreek, Carthage, Cincinnati, Ohio, is offering the No. 725 continuous drum type washing and drying machine for cleaning many types of metal parts. This machine consists of a soak wash, spray wash, drain and dry, the work passing continuously from one section to the next. In its course the work is gently agitated but never dropped, so that delicate work can be readily handled without injury.

The solution in the tank is heated by a gas burner burning in submerged serpentine flues. Work is dried by air which is blown onto it through holes in a pipe which extends through the center of the drum, the air being heated by the exhaust from the gas burner. Solution is sprayed onto the work from a pipe which extends through the center of the drum and is circulated by a motor-driven pump. The drum is rotated by a geared-head motor, mounted to automatically provide take-up on the driving chain.



MAGNAFLUX DEMAGNETIZER UNITS



Type SB demagnetizers developed by Magnaflux Corp, 5916 Northwest Highway, Chicago, Ill, especially for use with d c Magnaflux inspection units are made in openings of 5x7, 9x11, 14x16, and 28x11 in The 5x7 in size is made for bench mounting, the 9x11 in size is mounted on its own stand, while the two larger sizes are mounted on their own stands and equipped with a conveyor track and roller carriage for easy handling of heavy parts

Outstanding improvements over previous models include approximate doubling of demagnetizing efficiency, and a great reduction in the length of the coil, which reduces space and makes for easier operation Units are furnished either with hand switch or with an automatic timer

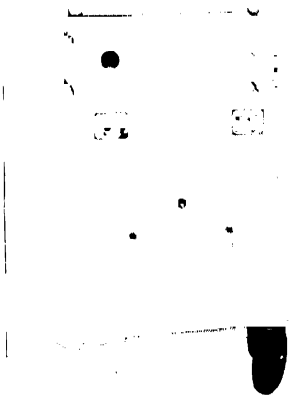
RANSCHOFF CONVEYOR TYPE WASHER AND DRYER

The No 64-N conveyor type washing and drying machine developed by N Ranschoff, Inc, W 71st St at Millcreek Carthage, Cincinnati, Ohio is intended for cleaning parts which cannot be put through drum type machines

In this unit cleaning compound is sprayed onto the work through countersunk holes in transverse pipes located both above and below the conveyor Ends of the pipes extend through the side of the machine to provide for easy cleaning and proper setting of sprays Before returning to the tank the solution passes through removable baskets which screen out chips and other foreign matter removed from the work Oil and scum are floated off over a skimming dam located in this same extension Solution in the tank is heated by gas, burning in submerged serpentine flues This machine has no dryer section, but one can readily be incorporated where the nature of the work makes one necessary



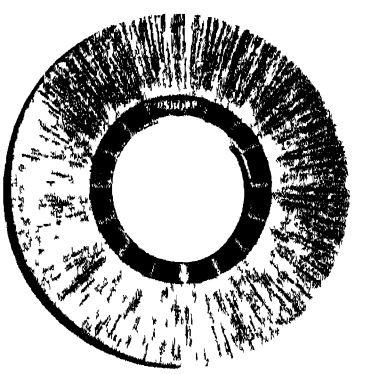
MAGNAFLUX INSPECTION UNIT



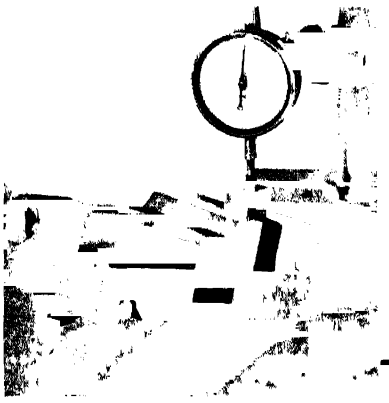
The Magnaflux Corp 5916 Northwest Highway, Chicago, Ill, has developed a portable inspection unit particularly adapted to the inspection of welds Identified as the KQ 1, it operates from 220 or 440 volt, three phase 60 cycle a c and delivers full wave rectified current Output current is up to 600 amp d c for continuous service, and up to 1 200 amp may be drawn intermittently Remote control is provided so that one man operation is possible This unit is also made in the Type KQ-04, which delivers up to 400 amp d c

Both units are sturdily constructed, with heavy 8 in composition swivel casters for easy handling around the shop They are claimed to give very sensitive results in the location of both surface and subsurface defects

OSBORN "RINGLOCK TAMPICO" SECTION BRUSH



An outstanding development of the Osborn Mfg Co 5101 Hamilton Ave Cleveland Ohio is the Ringlock Tampico section power driven brush This construction locks in the fiber by a one piece ring and sleeve thereby reducing breakage and shedding Several types and sizes of this new design of power driven brush are available for various industrial applications



MARBURG "ANGLEMASTER" SINE VISE

Marburg Bros, Inc, 90 West St, New York, N Y., has developed the Anglemaster sine vise to serve both as a rugged tool and a precision gage Made of suitable steel, heat-treated and seasoned before finishing, this device quickly and accurately handles angle grinding, inspection and layout

Precision sine rolls permit accurate angle setting In grinding, ordinary magnetic chucks will hold the device at any angle by means of a size block or planer gage The non projecting telescoping screw provides pressure to the slide jaw where it is most effective Knurled screw knob, held in place by an internal spring, is easily detached after work is correctly set, insuring against accidental changes in set up

Specifications Length over all, 6 in , length between sine rolls, 5 in , depth of jaws, 1 in , jaw travel, 3 in

IMPROVED CARBOLOY ROUND HOLE DIES

Availability of standard Carboloy round hole dies for drawing sizes of bar and tubing up to 3½ in in diameter, and improvements in construction in the larger series—R7 to R16—of standard drawing dies, have been announced by Carboloy Co , 11149 F Eight Mile Rd , Detroit, Mich Tendency to use cemented carbide dies for larger sizes of bars and tubing has led to the introduction of the R 18 type as a standard Carboloy die Nib dimensions of the die are 5 50 in diameter by 2 125 in height, with a casing dimension of 9 x 3¾ in It is designed for drawing work ranging from 2¾ to 3½ in in diameter

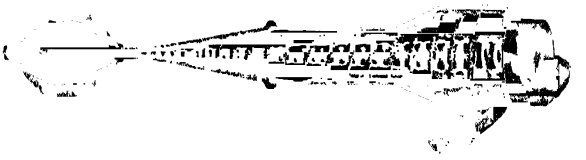
In addition, cored dies previously available only in the smaller—R1 to R6—series, are now also available in the series R7 through R10, for drawing fractional sizes of bar and tubing from $\frac{1}{16}$ to $\frac{3}{4}$ in diameter

Principal improvement in the larger series of dies, from the R-10 through the R 16 is a material increase in nib size to provide a longer bearing for easier push start bar drawing and tube sinking Increases in height for the various dies range from $\frac{1}{16}$ to $\frac{1}{8}$ in Recent price reductions apply to these dies

AMERICAN "CYCLONE" DUST COLLECTOR

American Foundry Equipment Co , 580 South Byrkit St , Mishawaka, Ind , has developed its Cyclone type of dust collector to provide unusually high efficiency in separating dust from air

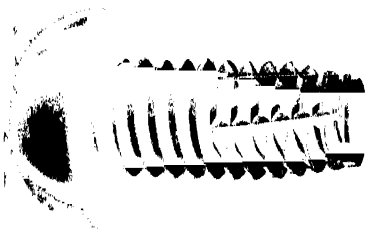
In operation, dust is separated from air stream by centrifugal force Careful proportioning of the unit results in unusually high efficiencies with relatively low back pressure Air volume can be varied from rated capacity to a great extent without seriously affecting efficiency The unit can be built in various sizes to suit requirements



BALDWIN-SOUTHWARK "METALECTRIC" STRAIN GAGE

Both static and dynamic types of the SR 4 bonded Metalectric strain gage have been made available by Baldwin-Southwark Div of Baldwin Locomotive Works, Philadelphia Pa The static type will measure a stress of as little as 20 lb per sq in in steel, and the dynamic model will handle frequencies up to 30 000 cycles per second

PARKER-KALON SELF-TAPPING SCREW



Parker Kalon Corp , 200 Varick St New York N Y , has developed the Type F self-tapping screw especially for use in materials of a crumbling or granular nature such as cast and malleable iron The tap-fluted pilot of this screw makes it capable of truly cutting a thread in the material as it is screwed in The thread is so designed that, if necessary, a standard machine screw of corresponding size may be screwed into the thread formed by the screw The Type F screw can also be used with a standard nut where an auxiliary fastening is required It can be driven with any type of screwdriver— hand, spiral, portable, electric or air

de SANNO ABRASIVE CUT-OFF MACHINES



An entirely new abrasive cut-off machine and an improvement on an older model have been made available by A. P. de Sanno & Son, Inc., Phoenixville, Pa.

The new Type M machine, for dry-cutting only, is of the heavy-duty bench type, and is designed to meet the demands for a machine which will cut heavier stock than the lighter machines and yet fit in the price range between the lower-priced machines and the high-priced ones. It uses a 12-in. diameter disk measuring $\frac{1}{16}$, $\frac{3}{32}$ or $\frac{1}{8}$ in. in thickness, driven from a 5-hp. motor through a multiple V-belt drive. The machine is provided with two sets of interchangeable wheel flanges, and has a special angular depth adjustment with quick acting locking device and a special quick-acting work clamp. Vise opens to 2½ in.

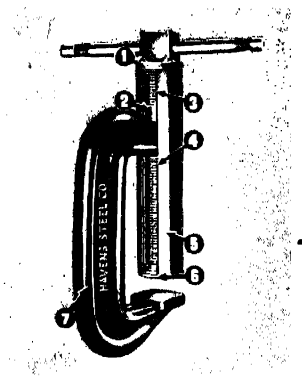
The old Type J machine has been improved to use an 18-in. disk in place of the former 16-in. disk, and a 10-hp. motor replaces the former 7½-hp. motor. These changes provide larger capacity.

WESTINGHOUSE "K-42-B" HIGH TEMPERATURE ALLOY

Developed by Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., the "K-42-B" alloy, though containing only 7 per cent iron, is claimed to be stronger than any known steel and to retain its strength at temperatures over 2,000 F.

This alloy is stronger at 1,100 F. than ordinary low-carbon steel is at room temperature, and has a low damping coefficient. Almost half of it is nickel; about a quarter is cobalt. It has other components including chromium, titanium and iron. Immediate uses are expected to be those of a special-purpose alloy for dies, turbine blades, and applications needing temperature-resistant metals.

The alloy creeps a great deal less than other metals in its class. In tests it showed a yield of only 0.0001 in. for each inch of length, and most of this had taken place during the first few hours. Under the same conditions a sample of high-strength nickel-chromium steel yielded 100 times as much.



SCULLY "HAVENS" PROTECTED C CLAMP

The "Havens" protected C clamp offered by Scully Steel Products Co., 1319 Wabansia Ave., Chicago, Ill., has been specially designed for welding shops. The shield or strong compression sleeve protects threads from damage and prevents weld spatter from clogging the threads. These clamps are made in shallow throat, medium throat and deep throat, in an assortment of sizes.

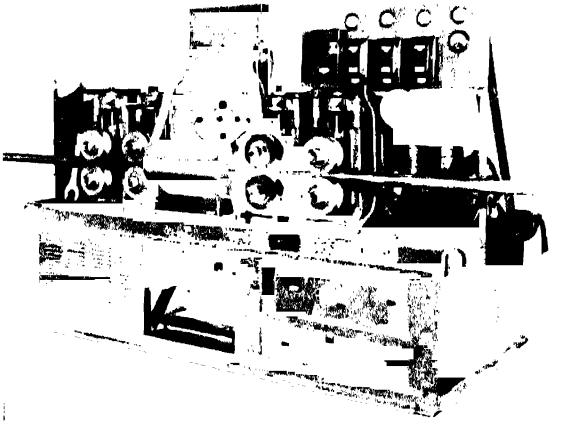
SPERRY ELECTRIC TUBE DEFECT DETECTOR

Several years of extensive research have culminated in the development of a non-destructive electric tubing defect detector by Sperry Products, Inc., 1505 Willow Ave., Hoboken, N. J. With this machine, tubing having either magnetic or non-magnetic properties can rapidly be inspected for many types of flaws.

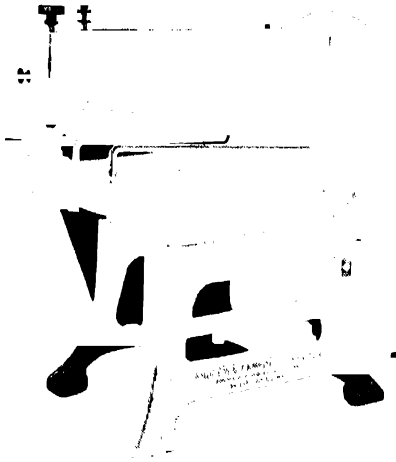
In operation, the tubes are fed automatically at a constant speed through the detection coils of the machine. Presence of a defect operates a signal lamp and at the same time immediately stops the tube feed. This equipment operates independently of the tube manufacturing process, and thus permits testing of tubes of different sizes and gages as a separate operation. The testing equipment is easily handled by one operator.

Types of defects which the machine will detect include surface flaws, checks, cracks, and slivers on both the internal and external surfaces; discontinuous defective welds, and long laminations. It is also useful in detecting "cupping" in lengths of bar stock.

The detector is compactly constructed and may be conveniently located in any tube mill. Simple and efficient operation is facilitated by table mounting of amplifiers, energizing and detector coils, drive rolls and controls. Underneath the table are mounted a motor-generator set for supplying the energizing current, the roll drive motors and other related parts.



CAMPBELL NIBBLING MACHINE



The No. 250 nibbling machine offered by Andrew C. Campbell Div. of American Chain & Cable Co., Bridgeport, Conn., features adjustable stroke, wide stock cutting, and three speeds. It is capable of cutting up to ¼-in. thick mild steel and $\frac{3}{16}$-in. thick stainless steel in widths up to 70 in. Throat depth of the unit is 36 in.

Stroke is adjustable so that it can be regulated to the thickness of the metal being cut. Adjustment is made by removing drive pin and turning shaft to pin holes which are located in such a way as to provide at least three strokes. Change from one stroke to another can be made in less than one minute. Speeds of 350, 500 and 800 r.p.m. are provided by a V-belt drive and step pulleys at the rear of the machine.

SCULLY HOT MARKING "PAINTSTICK"

The "Paintstick" for hot-marking metal slabs, offered by Scully Steel Products Co., 1319 Wabansia Ave., Chicago, Ill., has been made available in different grades. One is for marking at temperatures between 150 and 850 F., and another for marking at temperatures between 350 and 1,400 F. Both grades are supplied in two types. One type, the S-2, is not weatherproof, while the other type, W-2, is weatherproof. All are available in many different colors.

PHYSICISTS RESEARCH PROFILOMETER ACCESSORIES

Physicists Research Co., 343 Main St., Ann Arbor, Mich., has developed two accessories for the profilometer which extend the practical applications of the instrument, which itself has also been somewhat modified.

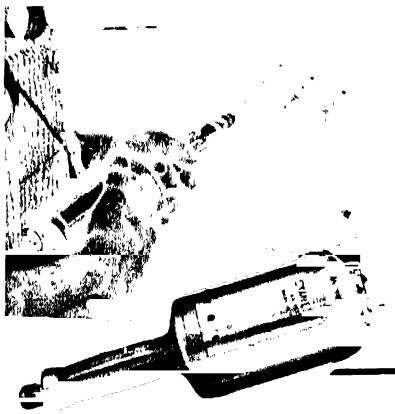
First accessory, the "Mototrace," moves the tracer across the surface to be measured. It has four specific applications: when the tracer is on very narrow surfaces or small areas where the available tracing distance is only $\frac{3}{32}$ to ⅛ in.; in awkward places near shoulders and holes, where the tracing distance is restricted on very smooth surfaces; where extraneous vibration makes manual tracing difficult; and in small holes or other surfaces measured with the Type I tracer described below. Two motions are provided. The first is a constant-speed linear motion, automatically reversing at both ends. Stroke is adjustable from ¼ to 2¼ in. The second motion is a cam-driven constant-speed quick-reversal reciprocating motion, adjustable from $\frac{1}{64}$ to ⅛ in.

Other accessory, the Type I special tracer, has been developed for measuring roughness inside holes as small as ½ in. in diameter. A modification for even smaller holes can also be furnished on special order. This tracer is also useful for measuring roughness of gear teeth and other difficult-to-reach surfaces. Close spacing of the pilot skids of this tracer makes it desirable to use the "Mototrace" described above for most applications.

A special Profilometer, with a one-micro-inch scale, can now be furnished. The most sensitive scale on the standard Type P instrument is three microinches. On especially fine work greater sensitivity is required. This special model incorporates an additional point on the range switch, giving three times the sensitivity of the standard model. Except for this modification it is identical in size and appearance with other Profilometers.



STANLEY ELECTRIC HAND AND TOOLPOST GRINDER



Stanley Electric Tool Div. of the Stanley Works, New Britain, Conn., has developed a compact grinder designed for both hand and lathe grinding. Known as the No. 153 grinder, this tool is nicely balanced for hand use, and with a motor holder can be mounted in a lathe, milling machine or shaper for external or internal grinding on dies, punches, cutters and machine parts.

A ⅜-hp. motor turns the spindle at 18,000 r.p.m. through a direct drive. Mounted on ball bearings, it has ample power to drive grinding wheels up to 1½ in. in diameter. Extended shaft gives a reach of 5 in. for deep internal grinding, and the long spindle housing provides a good grip for hand grinding. Grinder is furnished with a chuck for ¼-in. shanks. It may be supplied in voltages of 115, 125, 150, 220, 230 or 250 as required.

Armament

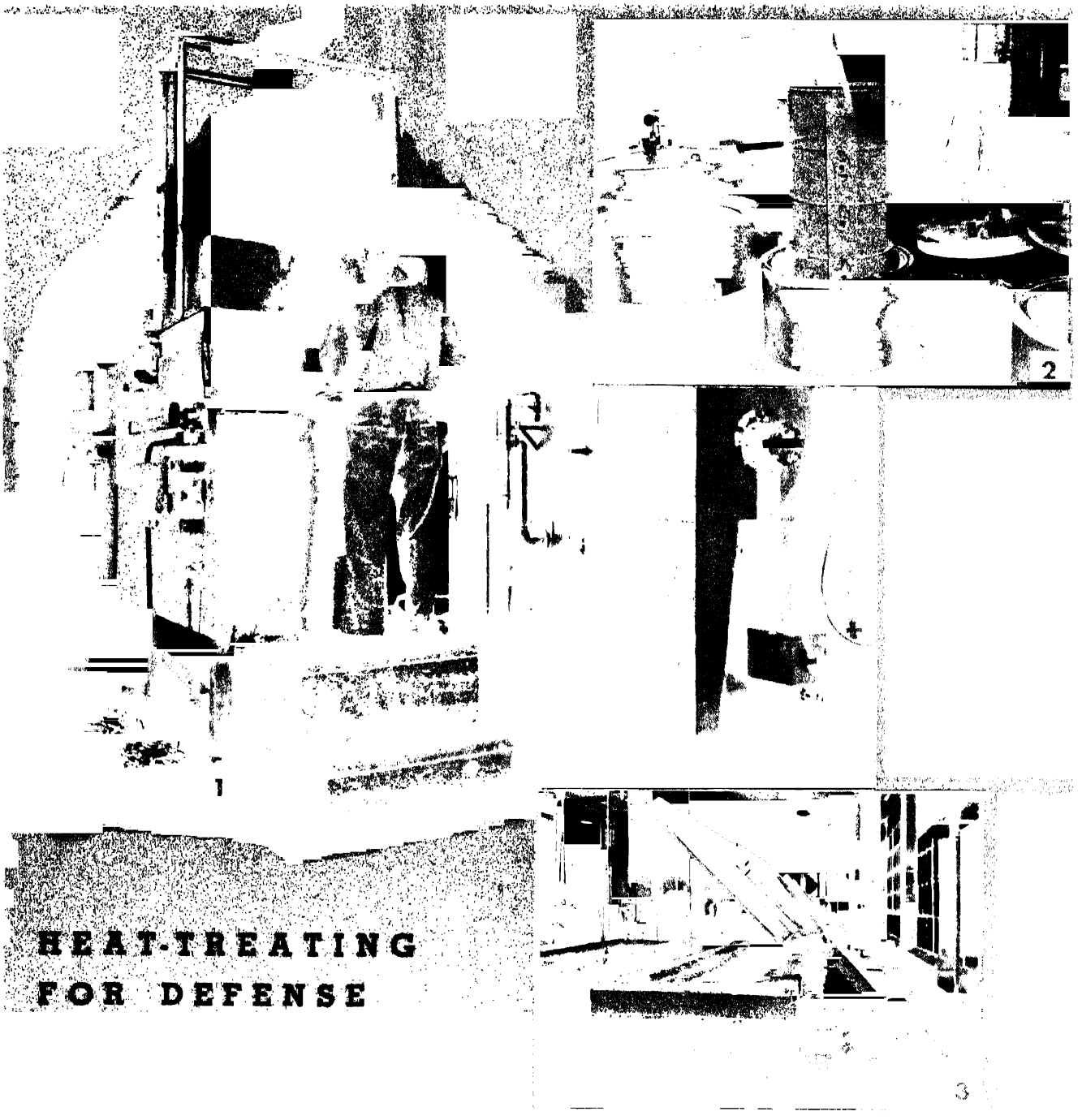
SECTION OF AMERICAN MACHINIST

HEAT-TREATING FOR DEFENSE





WELDING FOR DEFENSE

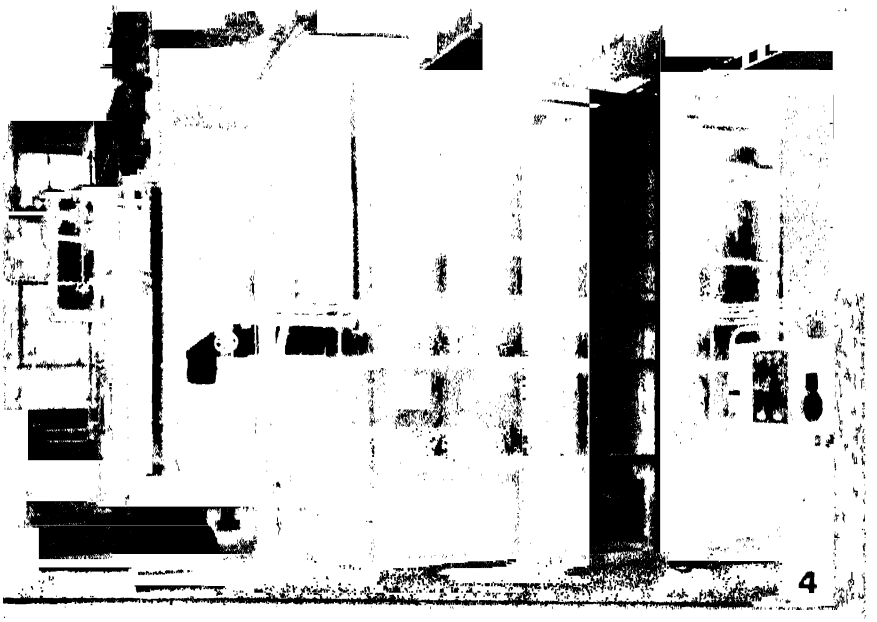


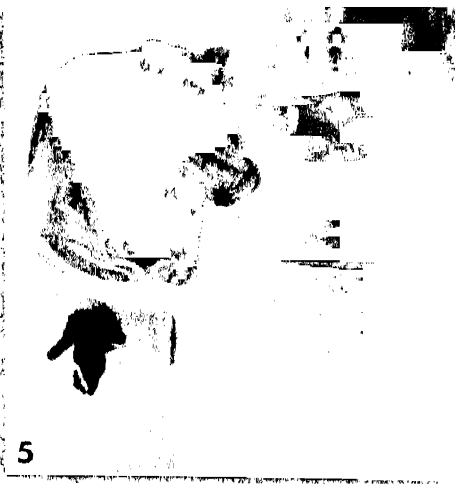
HEAT-TREATING FOR DEFENSE

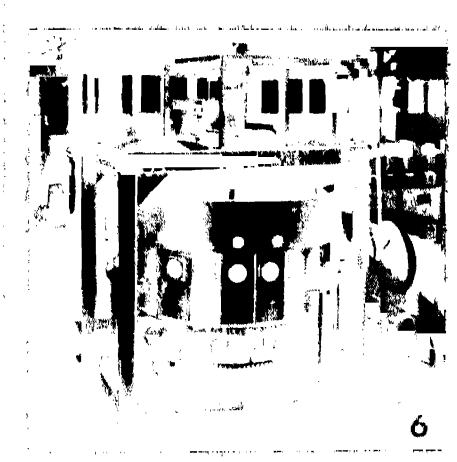
1. This electric furnace is equipped with "Endogas" generating equipment developed for short-cycle heat-treating carbon steels in a balanced protective atmosphere. The set-up involves pre-adjusting the composition of the furnace atmospheres to equilibrium with the carbon in the steel being heat-treated. The gas generating equipment can be applied to practically all types of furnaces and uses ordinary natural or manufactured fuel gases with satisfactory results. Furnaces equipped with such generating units are suitable for scale-free "bright" hardening of a wide range of parts, and are applicable for the heat-treatment of armor-piercing shells for anti-type and anti-aircraft guns, for parts used in tanks and other ordnance assemblies, and for aircraft engine parts.

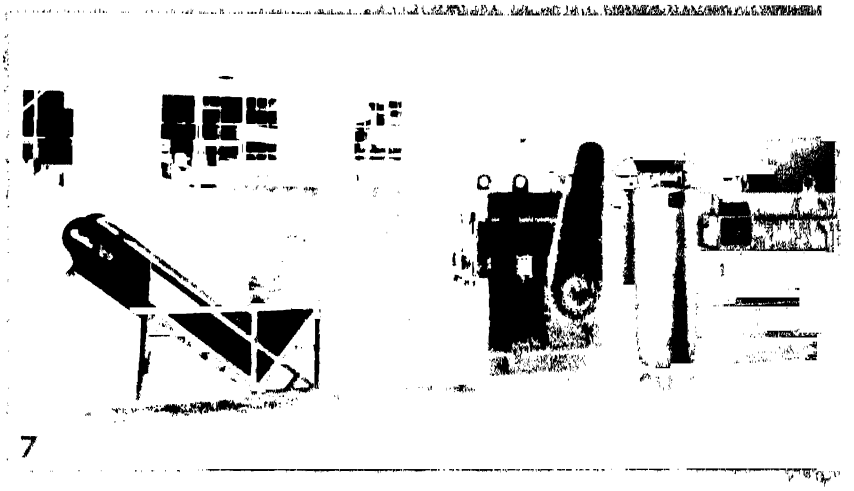
2. These pots, filled with engine cylinder liners, have just been removed from the carburizing furnace shown at the left, and are being lowered into a gas atmosphere cooler. The liners come out of the furnace at 1700 F. and must be left in the pots in the cooler for 3½ hr. before they can be handled.

3. Several hundred electrically-heated salt baths have been installed by American industry duirng the past few years. These installations range in size from small pot-type baths for heat-treating rivets to large production baths 20 to 30 ft. long for heat-treating aluminum-alloy aircraft assemblies. This unit, recently installed in Buffalo for the Curtiss Aeroplane Div. of Curtiss-Wright Corporation, has inside dimensions of 3 ft. wide, 4½ ft. deep and 15 ft. long. It is heated by 24 immersion-type units placed directly in the molten salt. Maximum operating temperature is 1000 F. The two-piece motor-operated cover is shown in the half-raised position. Operation of the cover is remote-controlled from a conveniently located pushbutton station.









4. This car bottom type recirculated air furnace is used by York Safe & Lock Company for stress relieving welded gun mounts and other structures. The car for this furnace has a capacity for a load of 10,000 lb., and the furnace will heat 5,000 lb. of steel per hour to 1120 F. As previously described (*AM*—Vol. 83, page 405), the complete cycle for a load in this furnace averages 20-24 hr. A bank of recording pyrometers with thermocouples at sixteen positions check the furnace temperature during the entire annealing cycle. These pyrometers, together with other control instruments, are mounted on a panel board adjacent to the furnace.

5. Many of the gears used in aircraft engines are quenched in Gleason presses to prevent distortion. The segment shown goes into the press at 1380 F., having just been taken out of an adjacent furnace.

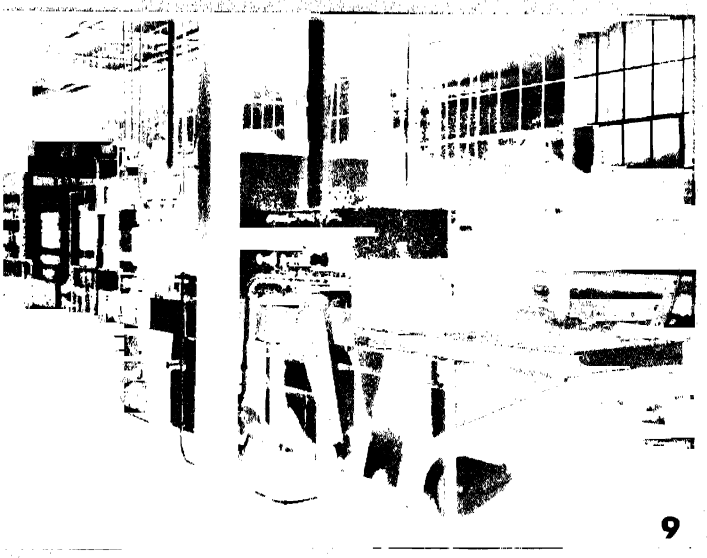
6. Developed especially for heating 155 mm. shells prior to nosing, this rotary furnace has capacity of 2,250 lb. per hr. when heating 9 in. of shell length to 1900 F. This corresponds to a capacity of 50 shells per hour. An interesting feature of this particular installation is that means are incorporated in the furnace to rotate the shells during the heating operation. Chief advantage of the rotary type furnace is that it requires only one operator for loading and unloading, in many cases the same operator can perform the nosing operation.

7. Steel belt links for 30 and 50 caliber cartridges must have sufficient spring to enable the gun to pull the cartridge out without jamming and yet must be strong enough to convey the shell into the gun. This makes the heat treatment of the links very important. Conveyor-type, electrically heated hardening furnaces of the type shown are especially suited for this operation. This furnace provides "Hydrizing" atmosphere for scale-free hardening.



8

8. Large aircraft engine forgings and miscellaneous other parts in various sizes and shapes are heated in oil-fired rotary hearth furnaces. This particular furnace is heated by means of oil-air proportioning type burners which are divided into two separately and automatically controlled zones. It is designed for operating at and maintaining any desired temperature from 1100 to 1800 F., and has capacity for heating 1000 lb. of material per hour to 1800 F. The rotary-hearth furnace is especially adapted for the heating of blanks from which steel shell are to be forged.



9

9. Especially suited for annealing brass, copper and nickel-silver drawn shells and stampings at temperatures from 600 to 1400 F., this gas-fired continuous roller hearth furnace has a spray quenching unit for cooling the material before it comes into contact with the air after the discharge from the furnace. The material to be annealed is loaded into light, skeleton-type heat-resisting alloy baskets or trays which automatically are conveyed through the furnace on driven rolls. Baskets are 30 in. long and 26 in. wide, hold 1100 lb. of material, in the set-up shown.



10

10. Extremely hard, abrasion, corrosion and wear resisting surfaces are produced on aircraft engine and other parts, without quenching, by heating them in contact with ammonia gas in semi-continuous nitriding furnaces of the type shown. This particular equipment consists of a movable furnace chamber mounted on track wheels and located above a structural hearth on which two or more nitriding retorts are placed. This view shows the top removed from one of the nitriding containers and shows the inner construction of the basket for holding the charge.

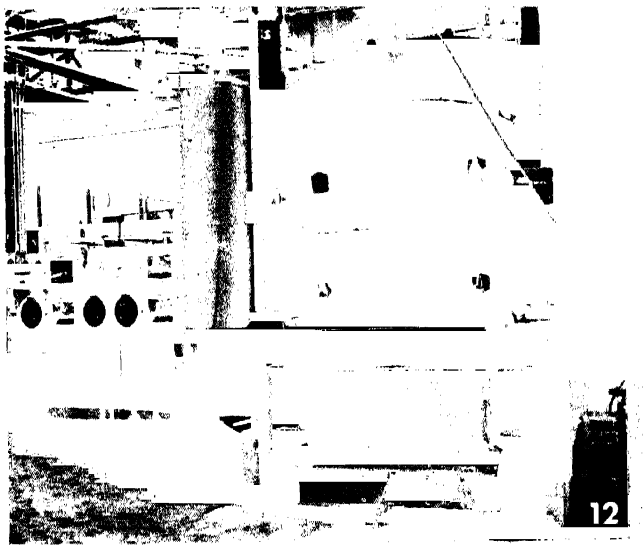
11. This special heat-treating furnace was designed by Northrop Aircraft engineers for heating and quenching formed aluminum parts. The parts are suspended in a special rack, as shown, and then drawn up into the furnace for heating. When the heated batch is ready for quenching, a single operation opens the bottom doors of the furnace and lowers the rack of parts into the 5 ft. deep quenching tank set below floor level.

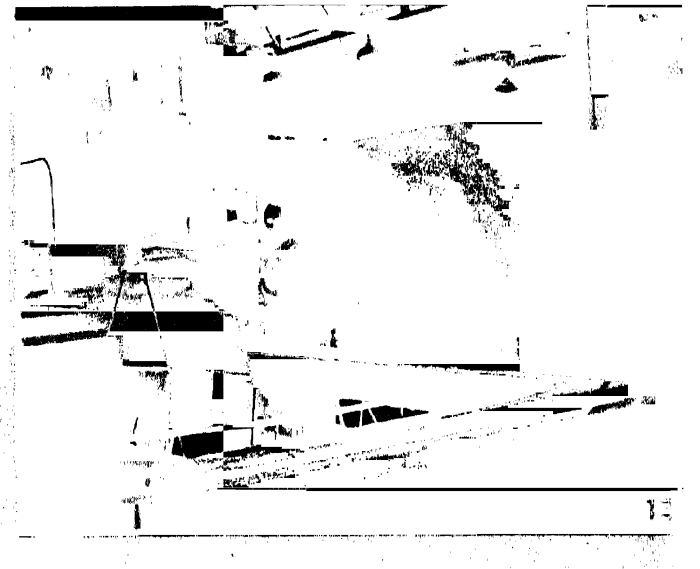
FOR DEFENSE

12. Engine mounts of welded steel tube construction are heat-treated in this gas-fired furnace at Consolidated Aircraft Corporation's plant in San Diego, Calif. The furnace is of the car-bottom type, so that the heated mounts can be rolled out of the furnace for air quenching. To prevent warping of the welded frame during cooling, the engine mounts are bolted to a steel table. Hold-down points on the table are heated before the mount is attached.

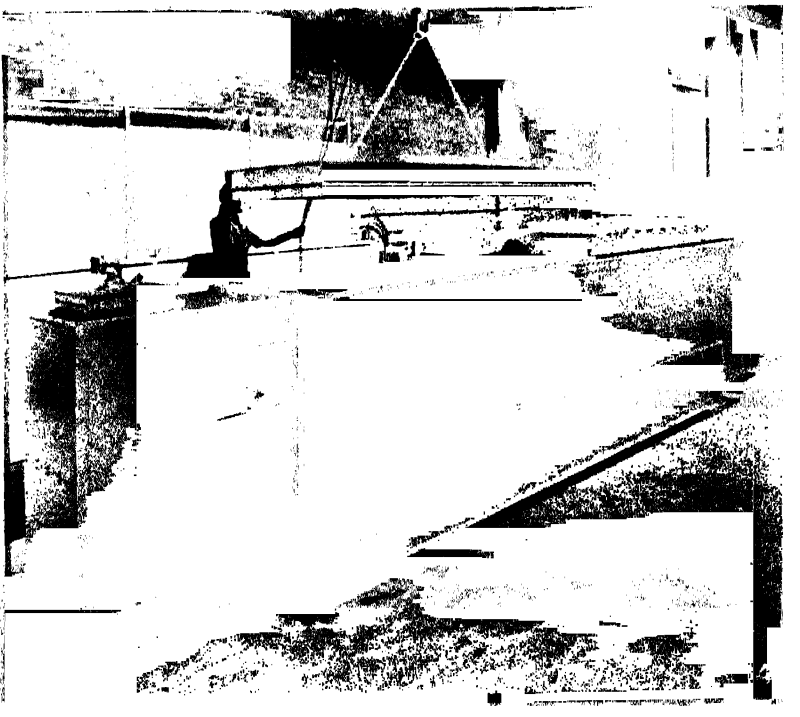

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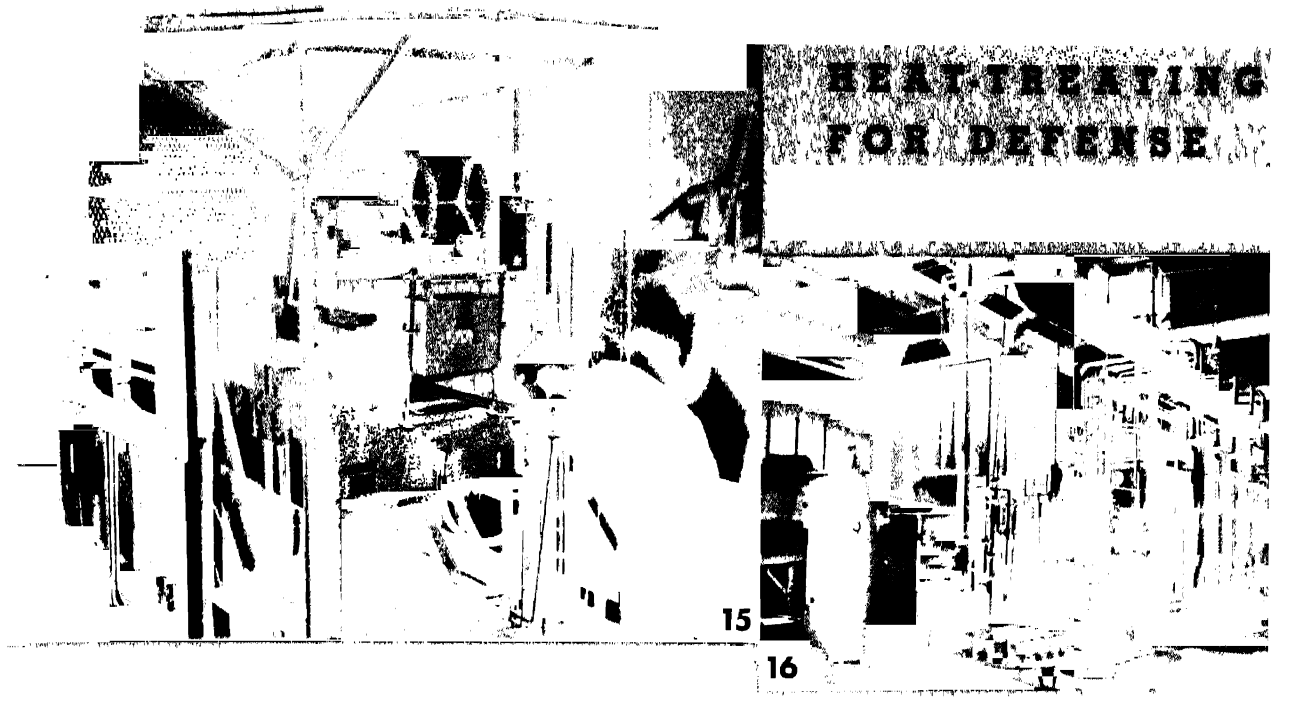
13. Many of the steel parts used in aircraft assemblies are heat-treated in salt-bath furnaces. This photograph shows the installation for this purpose at Lockheed Aircraft Corporation's plant in Burbank, Calif. Here parts are handled in large trays which are lifted into the furnace pots by overhead cranes.


12



14. Welded steel gun parts generally are stress-relieved at about 1125 F. in car-bottom type furnaces. Usually about two hours of soaking is allowed for each inch of thickness, and then the parts are allowed to cool to about 400 F. in the furnace. Improved air convection furnaces now are available which have capacities to take such assemblies, and are well fitted for armament work. The tops of these furnaces are removable, which makes it possible to load with a crane and reduces the amount of floor space required by the furnace.



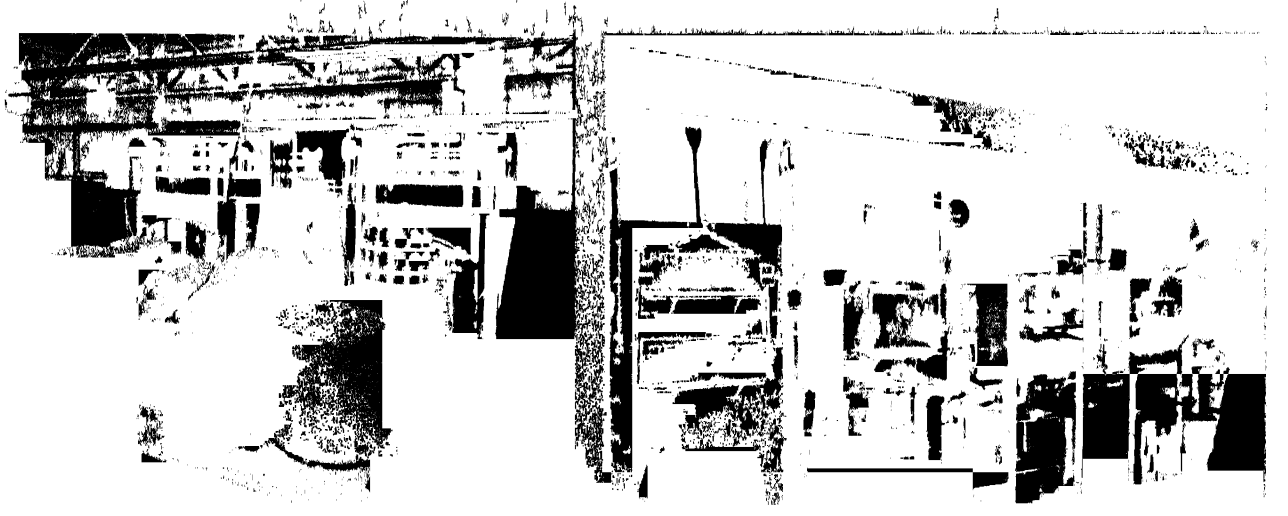


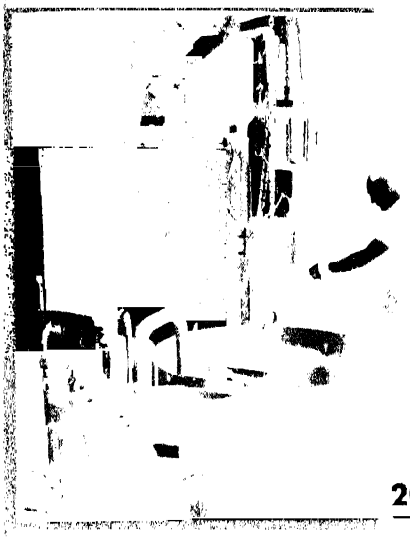
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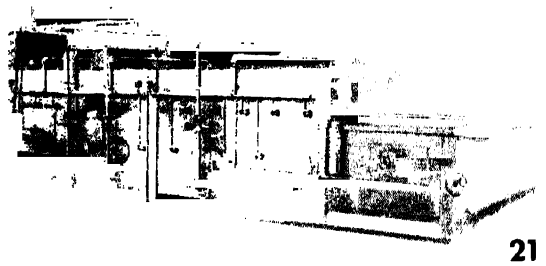




20

15. This Hayes controlled-atmosphere electric furnace has been installed at the New York Navy Yard for treating high-speed steel cutting tools, hobs, milling cutters and reamers. The unit shown is for preheating and drawing temperatures up to 1850 F. In the right background is a high-heat furnace with Globar heating elements for final heating up to 2400 F.

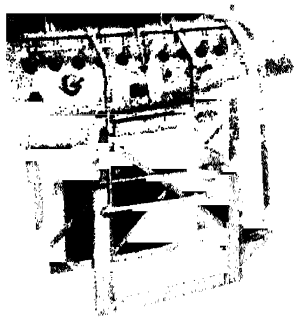
16. This pusher-type continuous furnace is used by Wright Aeronautical Corporation for hardening a number of parts, including connecting rods and crank shafts. It is a fully automatic gas-fired unit in which individual loads are pushed from one heating zone to the next, while gradually being brought up to the desired maximum temperature. At the discharge end of this furnace, shown in the foreground, is an automatic oil quench and a cleaning unit which consists of an alkali wash and water rinse. After passing through the cleaning unit, individual loads automatically are delivered to one of two conveyor lines, the individual line being selected automatically by means of control keys placed in one corner or the other of the front edge of the load.



21

17. Hevi Duty electric retort furnaces are used at the New York Navy Yard for carburizing and nitriding wrist pins, plungers, cams, cam rollers and fulcrum pins needed for the diesel engines now under construction for small naval craft and for auxiliary service aboard warships.

18. Aircraft engine cylinder forgings are nitrided in electric furnaces of novel design recently installed by Wright Aeronautical Corporation. Each furnace is of 150 kw. capacity, and is set into the floor so that the hearth is at floor level, permitting easy handling of the loads when they are lifted by crane into the nitriding pots. Fifty-four cylinder forgings are loaded into each of the three pots at one end of each furnace hearth, then the furnace itself is moved along tracks over that end of the hearth. Each heating cycle includes 10 hr. for bringing the load up to heat, a 35-hr. soak at 1000 F. and a cooling period during which the load is brought down to about 400 F. During this heating and cooling cycle, the three bells at the other end of the hearth are removed, after their loads have cooled to room temperature, and the nitrided cylinder forgings are removed. The bells then are reloaded, ready for the furnace to be moved back into position for heating these three loads. It is of interest to note that the steel grating around these furnaces is removable for easy access to the lower portion of the furnace, permitting easy inspection and maintenance.



22

19. Gas-fired furnaces, such as these in the tool room at the New York Navy Yard, are used for heat-treating high-speed steel tools. The Bellvue furnace at the left is a combination pre-heating and high-heat unit. Temperatures range up to 2400 F. Recent installations of similar steel-treating furnaces have included some of the electric type.

20. Valve bodies for high-pressure steam, water, air, and oil lines on naval vessels are stress-relieved in electric furnaces similar to this Hevi Duty unit in use at the New York Navy Yard. This furnace also is used for hardening and drawing parts for diesel engines.

21. Designed for normalizing and hardening rifle forgings, this furnace has a heavy cast link conveyor and is arranged with the return loop inside the furnace. When normalizing, the quenching tank is drained and forgings are discharged onto the quenching conveyor for air cooling.

22. Standard rotary gas carburizing machines are used for annealing brass cartridge cases between drawing operations, for applying gun metal finish on rifle and revolver parts, and for hardening a wide range of small parts used in the production of ordnance items. The rotary-retort continuous machine shown is recommended for hardening 0.30 and 0.50 calibre cartridge cores. Automatic hopper feed, automatic conveying and discharge through a port in the retort end side of the machine insures the necessary hardness on every core. Capacity is 300 lb. per hour.





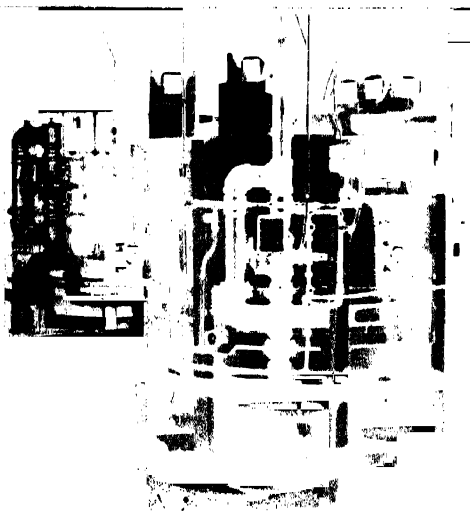
23. Ship piping is made with intricate bends to eliminate fittings and reduce weight. Cold and hot bends set up stresses in tight walls which must be relieved. This Mahr car-bottom type furnace at the New York Navy Yard has eight burners, is 10 ft. wide, 20 ft. long and 15 ft. high, and is suitable for stress-relieving piping. Heat is dissipated through fire brick channels which form part of the support for the charge, thereby keeping the charge out of direct contact with the flame. Temperatures up to 1850 F. are used.

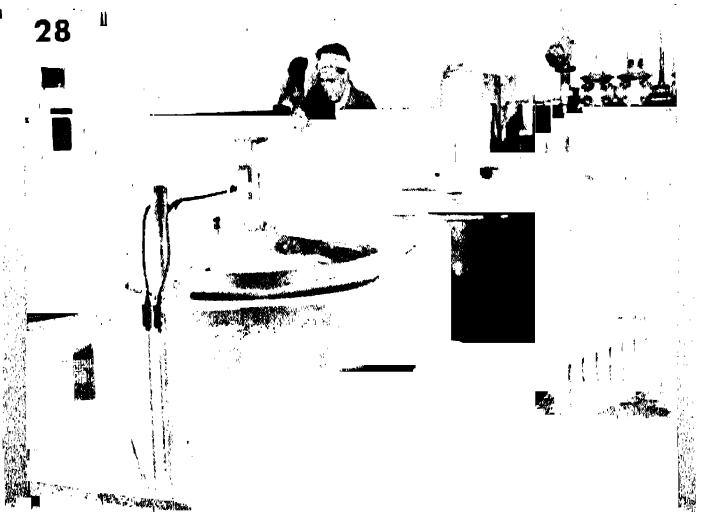
24. By gang-hardening sixteen sprockets at a time, one manufacturer has solved a production problem in the flame-hardening of teeth on rear drive sprockets for a popular line of tractors. Such applications of the flame-hardening process should find much application in the production of parts for tanks, combat cars, and many other ordnance assemblies. The trick in doing this particular operation succesfully was to make sure that the nested parts are clamped tightly together. Hardening is performed with two gear-hardening heads, each attached to an Oxweld blowpipe. The unit is driven by an Oxweld cutting machine. A speed of 7 in. per min. produces a $\frac{1}{8}$ to 3/16 in. depth of case, with the hardness of the flame-treated surface raised to 70 Scleroscope.

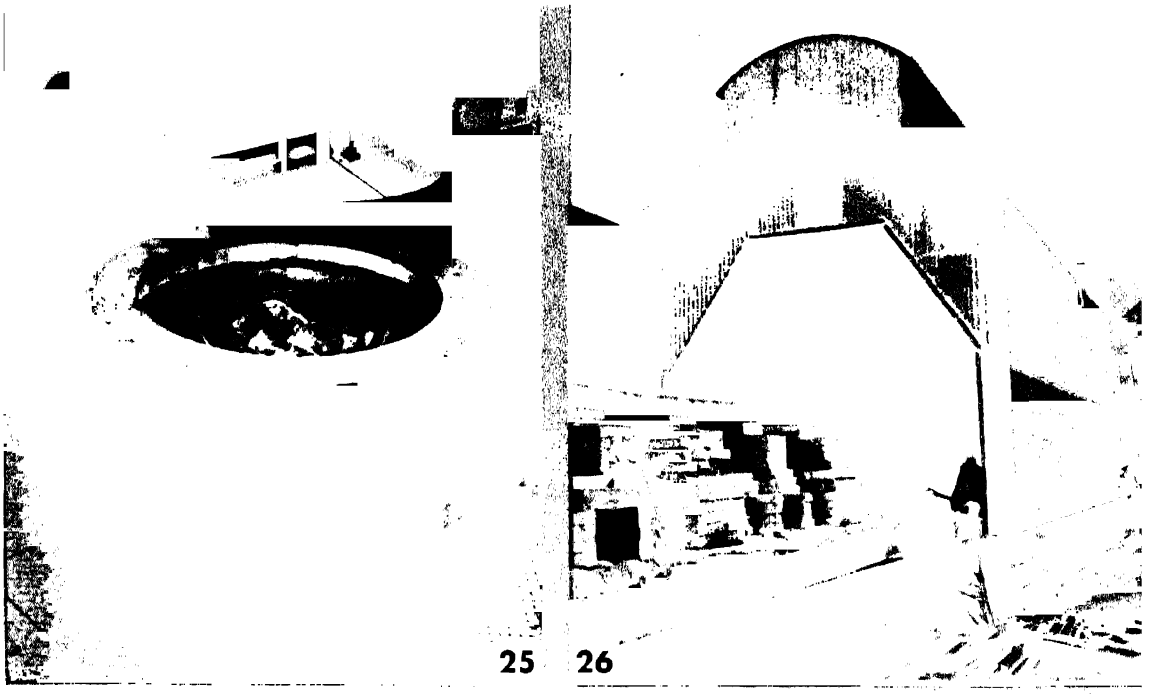
25. Homo tempering of magnesium-alloy bracket forgings is done in this furnace by Lycoming Division, Aviation Manufacturing Corporation. Such electrically-heated furnaces can be brought up to full temperature quickly under automatic control.

26. After stress-relieving long and odd-shaped pipe in car-bottom type furnaces, the charge is cooled under sheds which control circulating air current. This shed at the New York Navy Yard is rolled against the furnace and the charge pulled into it. The shed then is moved into the position shown for removing the charge. This method of controlled cooling speeds the stress-relieving cycle.

27. Rotary hearth furnaces long have been used for heating steel blanks for forging. Such furnaces are available with inside diameters ranging







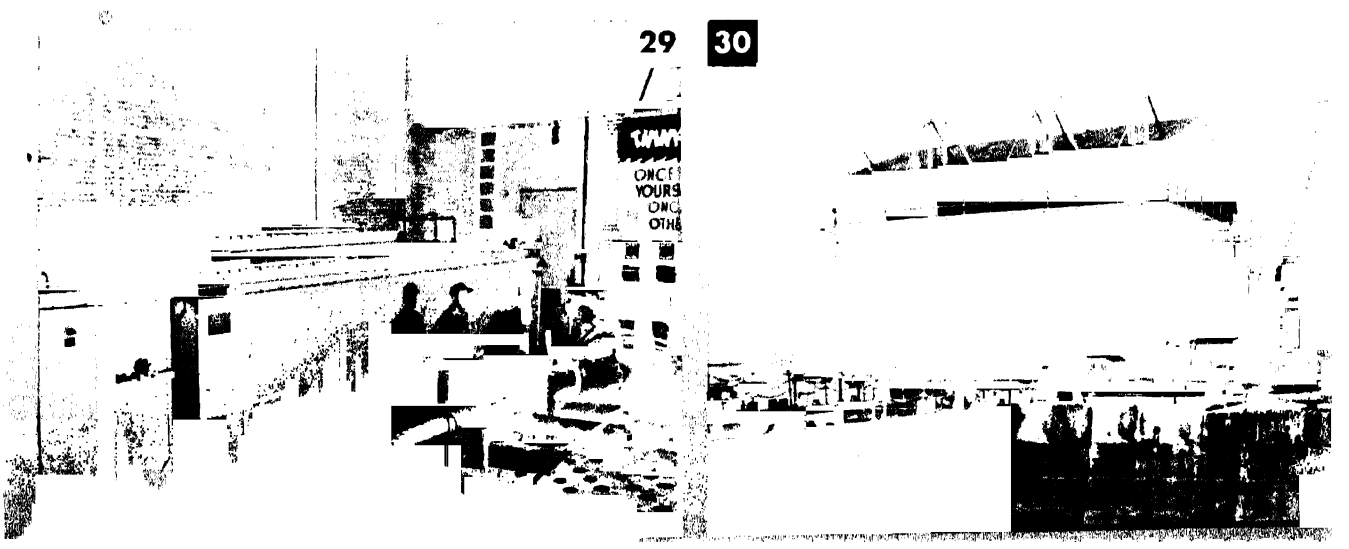
25 26

up to about 25 ft., and have been built with rated capacities of up to about 20,000 lb. of steel heated per hour. Such furnaces are particularly suitable for heating blanks from which steel shell are to be formed. In the automotive industry blanks for forgings have been heated at rates as high as 150 lb. per sq. ft. per hr.; at this high rate there is some danger of melting the surface of the steel. While some makers and users of forging furnaces have suggested heating shell blanks at a rate of 60 lb. per sq. ft. per hr., others claim that a rate of 80 to 90 lb. per sq. ft. per hr. should be about right.

28. Builders of aircraft engines and aircraft accesories, such as engine starters, and magnetos, are finding much use for carburizing furnaces in the heat-treating of alloy-steel parts. Semi-machined crankshafts for Wright aircraft engines are stacked on a heat-resistant cast fixture as shown for economic loading in the carburizing furnace.

29. This Lindberg electric furnace recently was installed in the pipe shop of the New York Navy Yard for relieving pipe-wall stresses after bending long sections of large diameter pipe. Such pipe is bent by heating at the radius section, spraying water at the inside of the bend, and pulling the pipe with a winch until it reaches templet form. Furnaces set up adjacent to the bending tables in the pipe shop speed production on this difficult work.

30. Two of the largest recirculated-air type furnaces ever built have been installed by Surface Combustion Corporation at the New York and Philadelphia Navy Yards. They are used for stress-relieving large built-up sections of ship armaments, superstructure, and hull reinforcement. These furnaces have effective internal dimensions measuring 48 ft. wide, 56 ft. long and 29 ft. high. They will heat a charge of approximately 675,000 lb. to 1250 F. in 35 hr., starting with a cold furnace. The structural steel bed for the charge is mounted on rollers to permit necessary expansion and contraction. The furnaces are so large that the only practical way to load and unload them is to remove the roof, which is made portable for this purpose.



29 30

Arc Welding Aircraft Tubing

Electric arc welding of SAE 4130 and X-4130 steel aircraft tubing has been applied principally to the welding of structural parts, such as fuselages, landing chassis and control surfaces, as well as engine mounts, aircraft boilers, etc It also found much use in the production of jigs and fixtures used in air-craft production operations For control surfaces, electric arc welding has been used satisfactorily for metal as thing as 0 031 in Direct current metallic arc welding is used exclusively. The arc permits compelte weld penetration, and for metal thicknesses up to 3 32 in the bead will appear on both surfaces of the seam

The narrower zone affected by the welding heat and the reduction in contraction and expansion due to the more localized application of heat, are considered advantageous for arc welding. Due to the very thin material used, small electrodes and low currents are required. It now is possible to arc weld down to 5-amp

With the shielded arc process, using a metallic electrode having a heavy extruded coating, welds may be produced in chrome-molybdenum steel having a tensile strength of 125, 000 to 150,000 lb per sq in after heat-treatment Before proper heat treatment such welds will develop a tensile strength of 60,000 to 80,000 lb per sq in

Using a carbon arc with a piece of the base metal as filler material welds can be produced in chrome molybdenum steel having a tensile strength of 60,000 to 70 000 lb per sq. in before heat-treatment. After proper heat-treatment, welds so produced will show a tensile strength of 125,000 to 160,000 lb. per sq. in

When using a proper shielded arc electrode, with electrode negative and work positive, and with an arc voltage of 23–26, a $\frac{1}{8}$ in. electrode will require 65 to 120 amp, while a 5/32 in electrode will require 80 to 160 amp

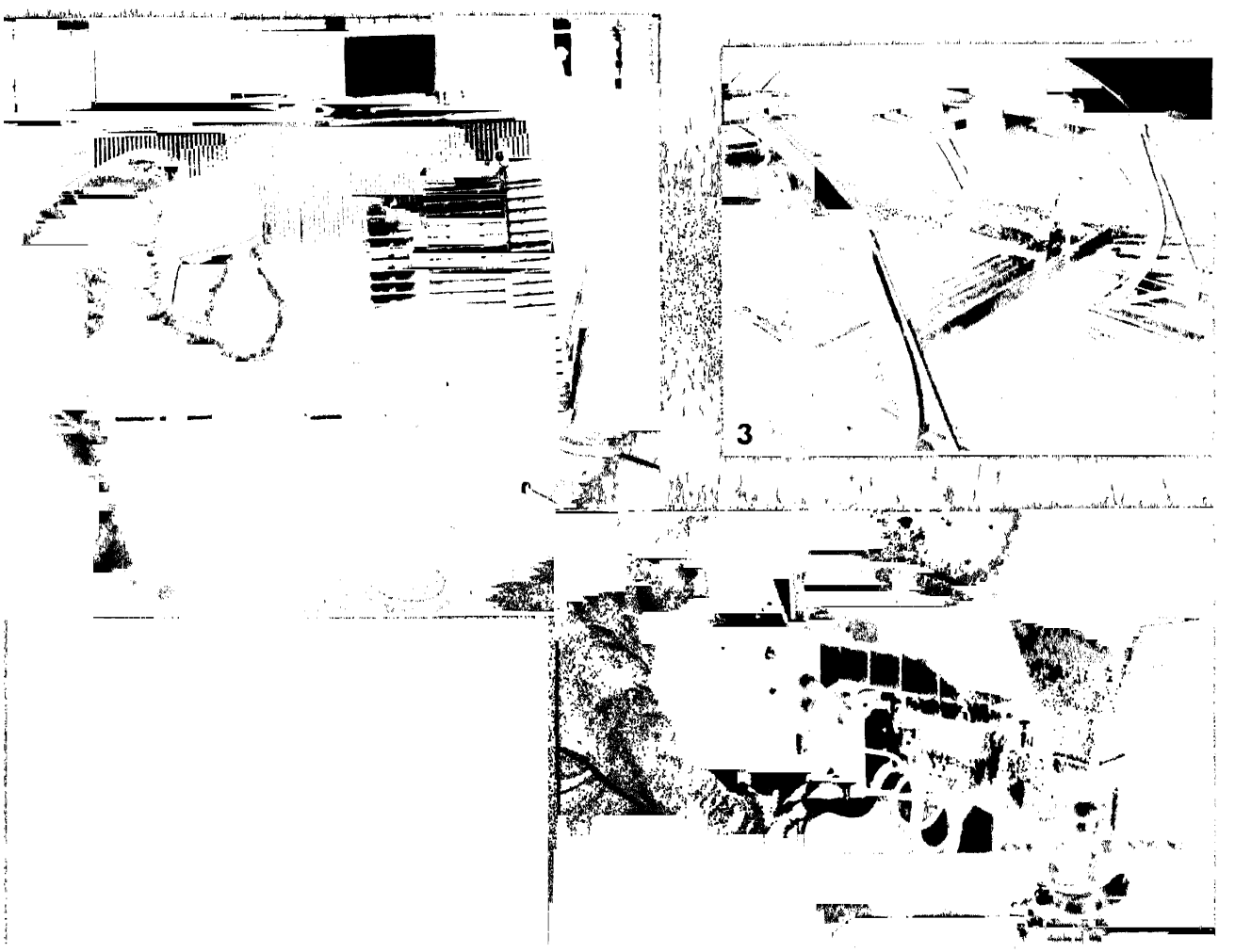
Heat treatment to be used after welding with the electric arc is approximately as follows

1 Normalize to 1650-1750 F and cool slowly in the furnace below red heat

2 Heat to 1660 1655 F and quench in light oil

3 Draw at about 950 F to secure desired hardness

Data from Lincoln Electric Company





1. With the "Weld-O-Tron" low-current electronic arc welder, which uses currents as low as 5 amp. with 1/32 and 3/64 in. electrodes, steel, stainless steel, Inconel and Monel can be arc welded in thicknesses as small as No. 32 gage. With suitable jigs, this method has been applied to welding exhaust stacks, collector rings and manifolds for airplane engines.

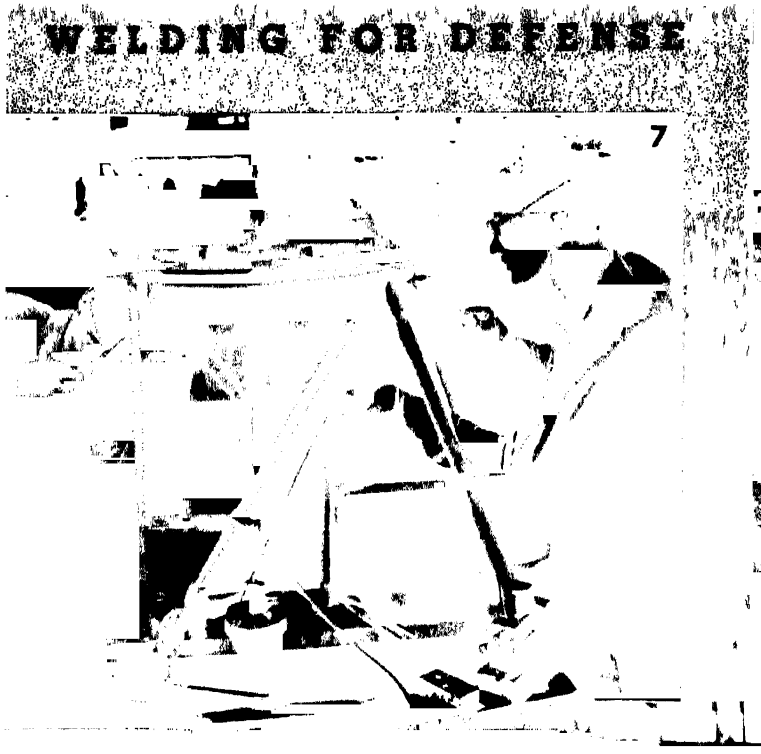
2. Fully automatic welding units are finding considerable use in shipyards to speed assembly of hull and reinforcing members. This "Unionmelt" unit was installed recently in the New York Navy Yard for making butt welds in heavy plate with one pass of the electrode. Simple edge preparation of the plate, little distortion, a weld flush with the plate, and high welding speed are advantages.

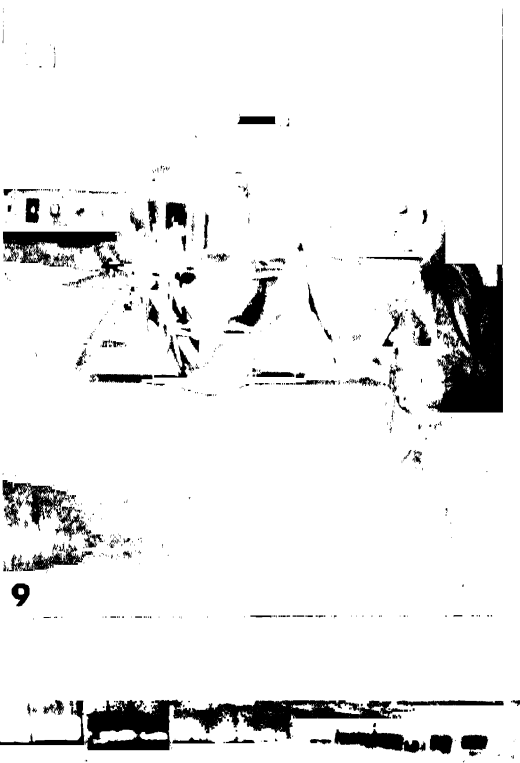
3. Some time ago the Welin Davit & Boat Corporation switched from cast and riveted construction to welding for the manufacture of boat davits, with about 30 per cent saving in fabrication cost. Each set of these davits is tested to carry 100 per cent overload, the set shown is intended to carry a full-loaded 30-ft., 70-person lifeboat.

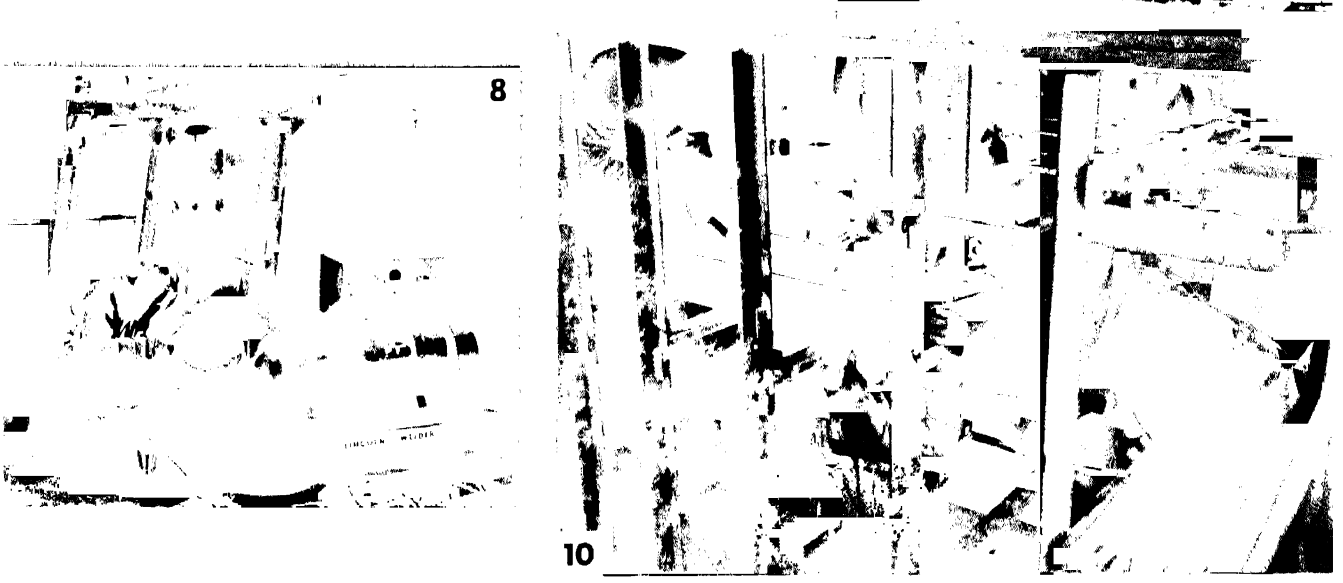
4. Individual welding booths in the structural, sheet-metal and pipe shops at the New York Navy Yard are equipped with portable arc-welding and gas-welding units for fabricating ship structural parts, as for example, this 12-in. gate valve casing. The structural shop has a large welding bay with slotted steel flooring for the assembly of large ship structures, including flooring, bulkheads and machinery foundations.

5. Many Army and Navy specifications for welded structures call for radiographic inspection of welds, in some cases this inspection is 100 per cent and in others the welds to be checked with an X-ray unit are selected at random. Both portable and stationary X-ray units are available for this type of inspection, usually they are fitted with universal tube supports which permit inspection of a weld at almost any position on a structure. The 220,000 volt portable X-ray machine shown is mounted on a truck.

6. Radiographs uncover hidden weak spots in welds or castings. Here, a technician is examining two radiographic negatives. The unblemished white line at the top is the X-ray picture of a perfect weld. The black spots in the bottom negative are caused by "slag holes" in the weld.







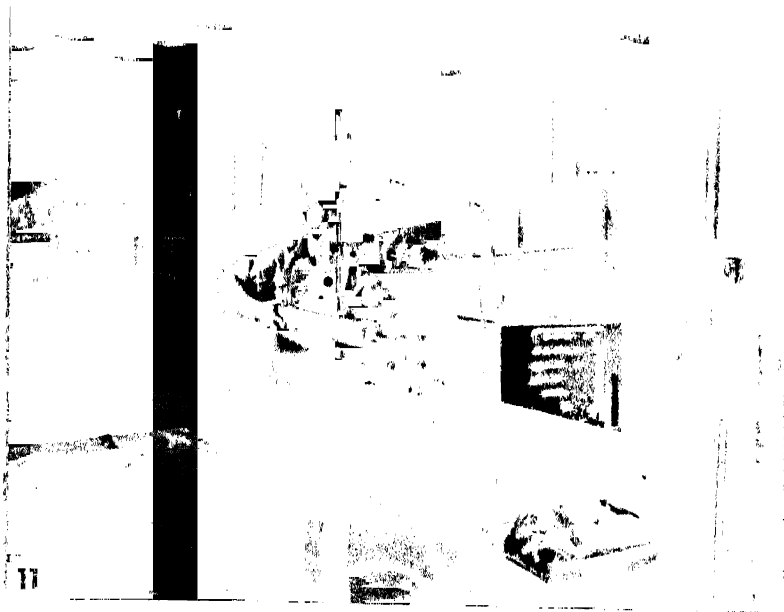
7. Here welders are oxy-acetylene welding the stainless steel tube structure of a Douglas airplane engine mount. Welding jig is of massive construction to provide complete rigidity throughout the welding operation. This jig is rotatable, may be raised or lowered, and is entirely inside the structure to be welded.

8. Many jigs and fixtures, engine mounts, nacelles, landing gear struts, and similar parts are assembled by electric arc welding in the aircraft industry. It is of interest to note that an inexperienced arc welder usually needs at least a year to become sufficiently skilled to do the type of work required in aircraft production.

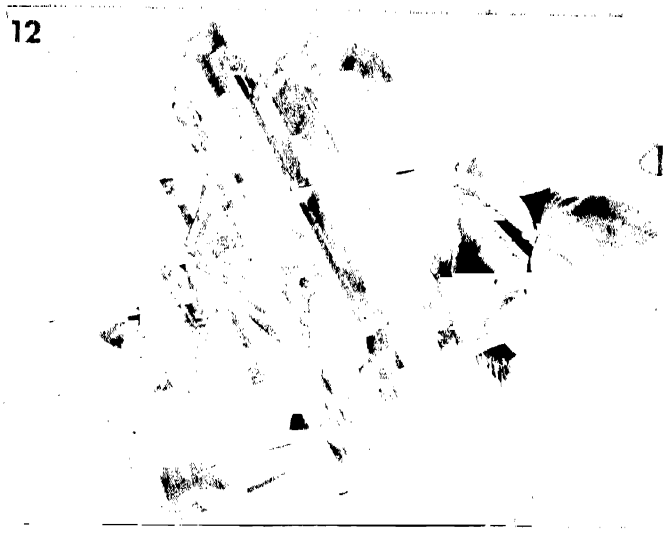
9. Automatic and semi-automatic welding equipment well proven by industry in many applications, will find much use in the production for defense program once industry really gets under way. Such units as this "Electronic Tornado" automatic welding head will have application in the manufacture of units for both the Army and the Navy.

10. Note the size of this jig, which is used to align parts welded together to form an engine mount for a V-type engine. The oxy-acetylene process is used for this welding operation in Consolidated Aircraft Corporation's plant at San Diego.

11. Two resistance welding machines built by Federal Machine & Welding Company, said to be the largest both in size and capacity in the aircraft industry, have been installed by Lockheed Aircraft Corporation to speed the production of airplanes for our armed forces. These machines are capable of welding two sheets of aluminum alloy $\frac{1}{8}$ in. thick with the 50-in. long welder arms spaced 18 in. apart. The wide arm spacing is necessary to permit welding of curved forms.







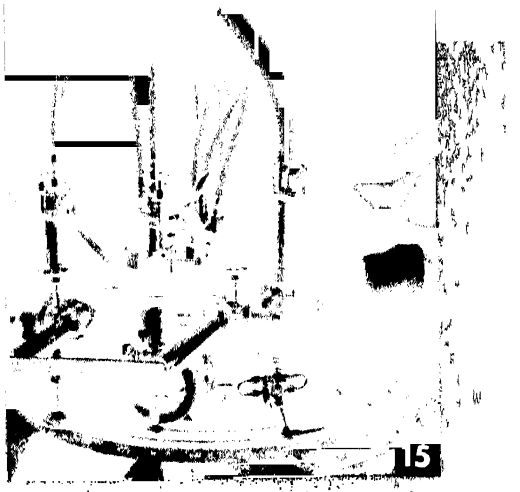


12. Welding specifications for assemblies required by the Army and Navy frequently specify that all structures be positioned so that welds can be made in a horizontal position. For economical production, therefore, weld positioners like this motor operated unit will be essential. The assemblies to be welded usually are tacked together in alignment fixtures, then transferred to the positioning tables for final welding.

13. Many of the engine manifolds in service on commercial airline planes in the United States, and on a high percentage of all military planes, are manufactured by Solar Aircraft Company in San Diego. These manifolds are fabricated from stainless steel sheet stock of 0.038 or 0.043 in. thickness. The oxy-acetylene process is used and because of the thin sections the welding operation is critical.

14. A major program of aircraft construction jig building has been under way at the Northrup Aircraft plant for the past six months and at present is continuing at an accelerated pace due to the expansion of our defense program. All assembly jigs are electric arc welded because this method is more rapid and does not distort the jig structure.

15. Oxy acetylene cutting and bevel ing of stiffener rings for brake drum flanges to be used on ship winches il lustrates an adaption of portable cutting machines for meeting special requirements This "Oxweld" unit is equipped with three blowpipes, the first for cutting the outside diameter of the ring, the second for cutting the inside diameter, and the third for beveling the outside diameter for sub sequent welding to the drum by 'Unionmelt' welding Three rings are cut, one inside the other, from a single square plate


15

16. Oxy acetylene gouging is used principally for gouging out the back side of electric welds to prepare the plate for rewelding Single V butt welds are used on the bottom plates of some welded ships In this in stance, the plates are 7/8 in thick and are butt welded from the inside by the "Unionmelt" process A gouging torch then is used for grooving the underside of the weld


16

17. The cost of producing many sub assemblies for metal airplanes can be reduced considerably through the ap plication of spot welding in place of riveting, where conditions permit The above photograph shows an elec tronically controlled spot welder in use on an aluminum alloy fuselage section Spot welders developed for the aircraft industry ordinarily have considerable throat depth

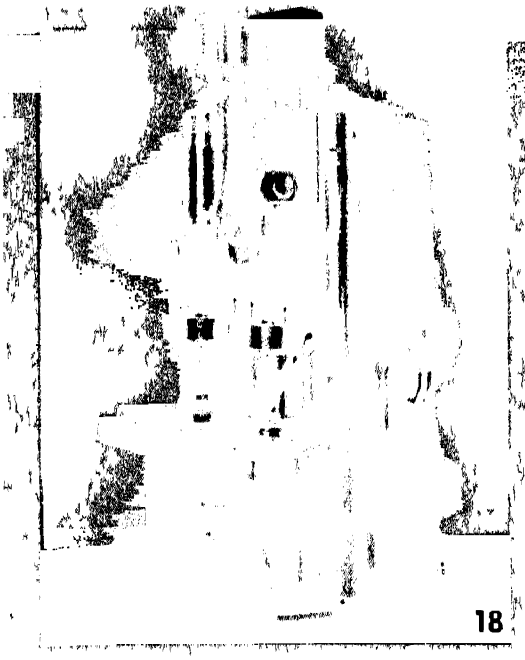

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18. Base covers for shell are bright soft annealed circular disks of sheet steel that are attached to the base of the shell by over lapped spot or seam welding (*AM*—Vol 84, page 667) The machine developed by Thomson-Gibb for this operation on 75mm and 3 in shell is standard, except for the tandem fixture To make welds, the operator puts a shell casing in each chuck, places a disk in position on the base of each, brings the weld ing wheels into position over one of the stations and starts the shell to rotating by pressing a pushbutton Welding current automatically is ap-plied while the shell is rotated 180 deg. When the first weld is complete, the operator shifts the slide to the second position and starts the second cycle While the second shell is being welded, the first station is unloaded and reloaded.

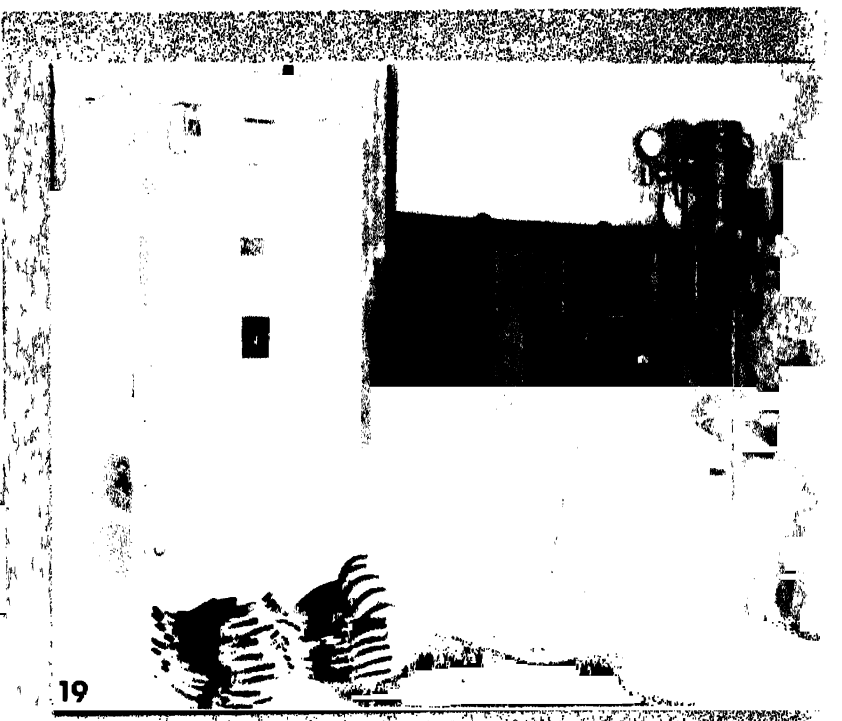
WELDING FOR DEFENSE

19. This Sciaky stored energy type spot welder installed in the North American Aviation plant is shown spot-welding an aluminum-alloy pi-lot's seat In this welder, the pres-sure and heat-adjustment are the major factors contributing to the quality and strength of welds in aluminum alloys Although spot-weld ing of aluminum has been done for many years, it is only recently that this process has been developed to a point where it could be applied satisfac torily in the production of aircraft When one considers the number of rivets driven in the wing of fuselage of an average airplane, at a cost of 3 to 4 cents per rivet, it is easy to see why satisfactory spot welding of aluminum-alloys is important

20. Many of the hull plates for both naval and commercial vessels must be cut to special size and shape, as must



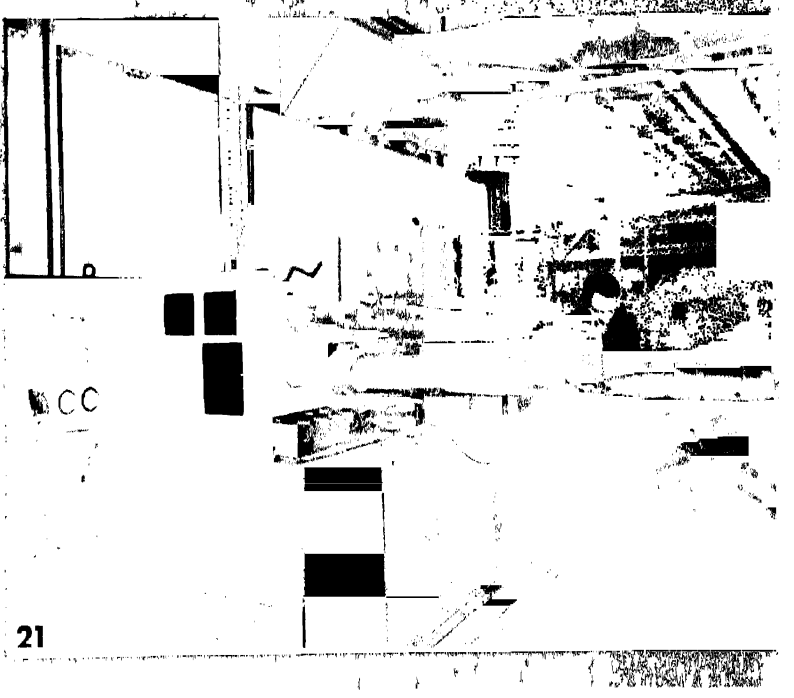
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21

many of the other structural parts inside the ship Oxy acetylene cutting machines of both the portable and stationary types are finding considerable application for such work Some of these plates are lap-welded and therefore do not require beveling, but in some cases plates must be beveled for butt-welding The photograph shows an Oxweld portable unit beveling a ½-in shell plate for the forward part of a tanker

21. Three basic types of equipment are suitable for spot welding aluminum and most of its alloys In addition to the electronically controlled ac spot welder shown here in use in the plant of North American Aviation Corp there are two types which operate by building up a high electrical charge and then discharging it after the welding tips have been brought against the material under predetermined pressure Of these, the Sciaky spot welder stores electrical energy in an induction coil so wound that the secondary discharges a high intensity current at low voltage The second, developed by Taylor Winfield and described in the "Show in Print" section of this issue, incorporates a high capacity condenser which is charged to a preset voltage which, after a predetermined time, discharges a high intensity current to make the spot weld

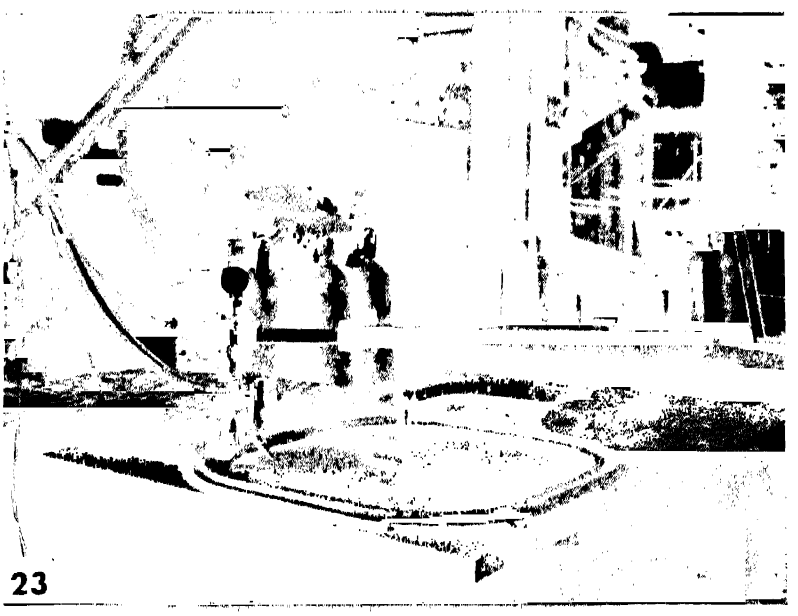
22. One of two large flame cutting units installed in Eastern shipyards for shaping floor plates and other elements for Class C cargo vessels this "Travograph" oxy acetylene unit permits mass production cutting where a number of vessels identical in size and design are under construction in the same yard The flame cutting set-ups in these yards probably are the largest installations of their kind at the present time

23. Difficult to machine hatch openings in armor plate can be cut in one continuous operation in this set up, which incorporates a templet controlled "Polygraph" oxy acetylene portable cutting machine Torch and driving units are mounted together in this unit

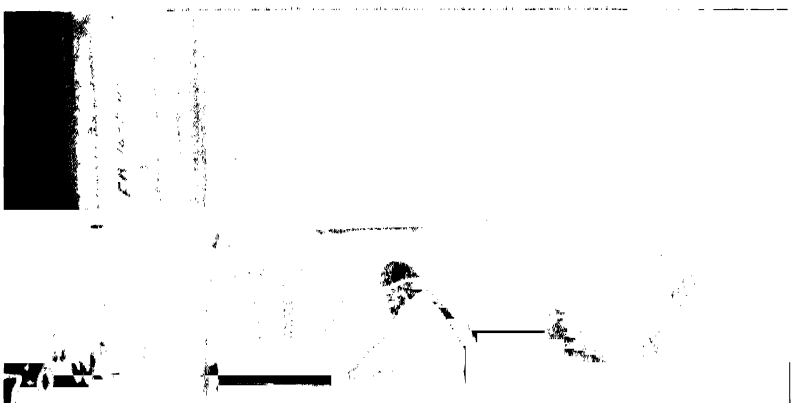
24. Flame-cleaning of structural steel assemblies prior to painting finds a major application in the ship building industry Here, a flame cleaning torch is being used for cleaning rusted bulkhead plates in the engine room of a tanker Immediately following the operator is shown a second man who goes over the flame cleaned surface to remove the loosened scale with a wire brush Paint then is applied so as to take advantage of the heated metal, which takes paint well



22



23



This section was made possible through the cooperation of the following organizations

Air Reduction Sales Company
Allis Chalmers Manufacturing Company
American Gas Furnace Company
Consolidated Aircraft Corporation
Douglas Aircraft Company
The Electric Furnace Company
General Electric Company
George J Hagen Company
Heyl Duty Electric Company
Leeds & Northrup Company
Lincoln Electric Company
Lindberg Engineering Company
The Linde Air Products Company
Lockheed Aircraft Corporation
North American Aviation Inc
Northrup Aircraft, Inc
Republic Steel Corporation
Solar Aircraft Company
Surface Combustion Corporation
Thomson Gibb Electric Welding Company
United Aircraft Corporation
United States Navy
Westinghouse Electric & Mfg Co
Wright Aeronautical Corporation

The Working of CARBON SHEET STEEL

THE PROCESS of rolling sheets was invented in England in the 18th Century. It appears that the first American sheet rolling mill was built in Pittsburgh in 1818 by the Pittsburgh Steam Engine Company under the superintendence of Joshua Malen. Today, about half of the steel made in the United States is now applied to the production of flat-rolled products.

The classifications of flat rolled steel products are listed in Table I. The United States Standard gages for sheet steel are given in Table II. The U. S. gage is a weight gage and not a thickness gage, being based on 41.82 lb. per sq. ft. per inch of thickness—the density equivalent of steel. Prior to 1938, this equivalent was 40.8 per sq. ft. per inch of thickness, but later 2½ per cent tolerance was added to the base weight to allow for crowning.

TYPE OF STEEL USED

Both low-carbon rimmed and killed steel are used for flat-rolled products. The rimmed steel has a thicker skin, which results in a sheet comparatively free from surface defects. A killed steel generally has a more sensitive skin which ruptures easily. For this reason, rimmed steels are almost universally used for sheet steel. However, killed steels have certain advantages such as uniformity of analysis, and comparative freedom from aging, the latter of which increases hardness and decreases ductility.

The composition of some of the higher grade of sheet steels is given in Table III. Except for vitreous enameling sheets it is desirable to keep the carbon content over 0.03 per cent. Manganese is important in improving surface toughness in drawing, but it apparently can contribute to blisters in pickling and galvanizing when its presence exceeds certain limits. If the manganese falls much below 0.20 per cent in rimmed steel, the rolled surface tends to be porous.

ANNEALING PRACTICES

Hot-reduced and cold-reduced sheet and strip steel must be annealed, unless a hard temper is desired. There are a number of annealing operations used, the most important of which are (1) the cold-strain low-temperature recrystalization anneal, (2) the normalizing operation, and (3) the stress-relieving anneal.

The cold-strain low-temperature recrystallization anneal is carried out by covering stacks of sheets or coils placed on a bottom plate, heating to 1,200–1,400 F., and allowing them to soak until the temperature is uniform throughout the charge. The charge is allowed to cool before uncovering. Material that has been cold-reduced or descaled before annealing is usually annealed in a protective atmosphere or "bright annealed" in order to prevent the formation of oxide on the sheet.

Normalizing consists of heating the sheet or strip to above the critical temperature and cooling to room temperature. This recrystallizes and refines the grain structure and improves drawing properties. The grain size and hardness of normalized material can be controlled by varying the soaking time and cooling rate.

The stress-relieving anneal is a low-temperature pack or box anneal used

Table I—CLASSIFICATION BY SIZE OF FLAT-ROLLED STEEL

Widths, In.	*Thickness, In.*						
Hot rolled	0.2500 or thicker	0.2499 to 0.1875	0.1874 to 0.0568	0.0567 to 0.0344	0.0343 to 0.0255	0.0254 to 0.0142	0.0141 to thinner
Up to 3½	Bar	Strip	Strip	Strip	Strip	Sheet	Sheet
3½ to 6	Bar	Strip	Strip	Strip	Sheet	Sheet	Sheet
6 to 12	Plate	Strip	Strip	Sheet	Sheet	Sheet	Sheet
12 to 32	Plate	Sheet	Sheet	Sheet	Sheet	Sheet	T.M.Black
32 to 48	Plate	Sheet	Sheet	Sheet	Sheet	Sheet	Sheet
Over 48	Plate	Plate	Sheet	Sheet	Sheet	Sheet	.....
Cold rolled							
Up to 12	Bar	Strip	Strip	Strip	Strip	Strip	Strip
12 to 24	Strip*	Strip*	Strip*	Strip*	Strip*	Strip*	Strip*
12 to 24	Sheet**	Sheet**	Sheet**	Sheet**	Sheet**	Sheet**	T.M.Black**
24 to 32	Sheet	Sheet	Sheet	Sheet	Sheet	Sheet	T.M.Black
Over 32	Sheet	Sheet	Sheet	Sheet	Sheet	Sheet	Sheet

* When a definite temper as defined in A.S.T.M. specification A-109, or a special edge, or special finish is specified.

** When no special temper, edge or finish is specified.

This section was made possible through the cooperation of the following companies:

Abrasive Company
Air Reduction Sales Company
Allegheny-Ludlum Steel Corporation
American Rolling Mill Company
American Society for Metals
American Welding Society
Carboloy Company, Incorporated
Carnegie-Illinois Steel Corporation
Cincinnati Shaper Company
Cleveland Crane & Engineering Co.
Cleveland Twist Drill Company
Cochrane-Bly Company
Continental Machines, Incorporated
E. F. Houghton & Company
Lincoln Electric Company
Linde Air Products Company
Morse Twist Drill & Machine Company
National Twist Drill & Tool Company
Norton Company
Republic Steel Corporation
Socony-Vacuum Oil Company
The Texas Company
Vanadium Alloys Steel Corporation
Victor Saw Works, Incorporated
Westinghouse Electric & Manufacturing Company

Table II—U. S. STANDARD GAGE FOR SHEET STEEL

Gage No.	Oz. per sq. ft.	Lb. per sq. in.	Lb. per sq. ft.	Inch equivalent for thickness
3	160	0.069444	10.0000	0.2391
4	150	0.065104	9.3750	0.2242
5	140	0.060764	8.7500	0.2092
6	130	0.056424	8.1250	0.1943
7	120	0.052083	7.5000	0.1793
8	110	0.047743	6.8750	0.1644
9	100	0.043403	6.2500	0.1495
10	90	0.039062	5.6250	0.1345
11	80	0.034722	5.0000	0.1196
12	70	0.030382	4.3750	0.1046
13	60	0.026042	3.7500	0.0897
14	50	0.021701	3.1250	0.0747
15	45	0.019531	2.8125	0.0673
16	40	0.017361	2.5000	0.0598
17	36	0.015625	2.2500	0.0538
18	32	0.013889	2.0000	0.0478
19	28	0.012153	1.7500	0.0418
20	24	0.010417	1.5000	0.0359
21	22	0.0095486	1.3750	0.0329
22	20	0.0086806	1.2500	0.0299
23	18	0.0078125	1.1250	0.0269
24	16	0.0069444	1.0000	0.0239
25	14	0.0060764	0.8750	0.0209
26	12	0.0052083	0.7500	0.0179
27	11	0.0047743	0.6875	0.0164
28	10	0.0043403	0.6250	0.0149
29	9	0.0039062	0.5625	0.0135
30	8	0.0034722	0.5000	0.0120
31	7.00	0.0030382	0.437500	0.0105
32	6.50	0.0028212	0.406250	0.0097
33	6.00	0.0026042	0.375000	0.0090
34	5.50	0.0023872	0.343750	0.0082
35	5.00	0.0021701	0.312500	0.0075
36	4.50	0.0019531	0.281250	0.0067
37	5.25	0.0018446	0.265625	0.0064
38	4.00	0.0017361	0.250000	0.0060

to remove internal stresses produced either by the rapid cooling in the normalizing operation of by leveling or light-rolling operations after normalizing. It improves drawing properties. Temperatures used range from 950 to 1,200 F. A protective atmosphere can be used under the cover to prevent oxidation. The charge may be steam blued if desired by addition of steam under the cover after the removal of the charge from the furnace when the temperature has dropped from 200 to 400 F. below that of the furnace.

Typical physical properties of mild steel sheets and strips after annealing operations are given in Table IV.

The surface texture of sheet and strip can be varied between wide limits, depending upon the surface treatment. For plating and similar uses, a smooth bright surface is necessary, but for vitreous enameling and many drawing operations, a certain dullness or roughness of surface is more suitable. Rough surfaces improve adherence for enameling and similar finishing. In certain drawing operations where heavy pressures are developed, the duller type of surface draws better.

TYPES OF SHEET STEEL

Cold rolling is practiced to obtain or develop certain qualities and properties, which may be classified as follows: (1) sizes thinner than that possible by hot rolling, (2) desired surface finish, (3) definite hardness or temper, (4) controlled edge characteristics. As the cold work on sheet and strip increases, the hardness is correspondingly raised. Cold-rolled material is produced in five different tempers as follows: No. 1, full hard; No. 2, half-hard; No. 3, quarter-hard; No. 4, soft or planished; and No. 5, dead soft. The approximate physical properties of each of these tempered steels, together with recommended uses, are given in Table V.

Fabricators of products made from flat-rolled sheet and strip can obtain the steel in the following forms:

1. *Hot-Rolled*—This term is usually applied to No. 16 gage and heavier products rolled on continuous hot-strip and jobbing sheet mills.

2. *Hot-Rolled and Normalized*—Hot-rolled sheet and strip in heavy gages are too hard for many purposes, and are usually normalized to increase their adaptability for fabricating operations.

3. *Hot-Rolled Pickled*—Sheet and strip are hot-rolled and pickled to remove the oxide coating in order to make them more suitable for die forming, welding, and application of protective coatings.

4. *Hot-Rolled Annealed*—This includes No. 17 gage and lighter sheet and strip which are first hot rolled, then cold rolled and box annealed; also, hot rolled, box annealed and cold rolled or roller levelled to flat. The sheet and strip have moderately good forming properties.

5. *Hot-Rolled, Pickled and Annealed*—Such sheet and strip are identical with hot-rolled annealed products, except that in this case hot-rolled sheet is pickled to remove oxide, flattened and box annealed.

6. *White-Finished Hot-Rolled Pickled and Annealed*—Such sheet and strip are identical with hot-rolled,

Table IV—PROPERTIES EFFECTED BY TREATMENT

Sheet Treatment	Tensile strength, lb. per sq. in. Yield	Tensile strength, lb. per sq. in. Ultimate	Elongation, % in 2 in.	Hardness, Rockwell B	Olsen cup, 0.04 in. thick
Hot-rolled sheet	50,000	68,000	10	70	0 200
Hot-rolled coiled strip	45,000	55,000	30	60	0.350
Hot-rolled + normalized	38,000	52,000	32	55	0.365
Hot-rolled + second anneal	30,000	48,000	38	50	0.390
Hot-rolled + cold reduced	85,000	85,000	4	90	0.120
Hot-rolled + bright anneal	28,000	45,000	42	45	0.410
Hot-rolled + normalize + second anneal	32,000	50,000	38	52	0.390

Table III—TYPICAL COMPOSITIONS FOR SOME HIGHER GRADE SHEETS

Grade of quality	Composition, per cent: Carbon	Manganese	Phosphorus	Sulphur	Silicon
Ordinary requirements, mild forming	0.05–0.08	0.20–0.35	0.005–0.05	0.005–0.05	Trace–0.008
Cold-forming, full cold-rolled stock	0.10–0.15	0.35–0.45	0.005–0.05	0.005–0.05	Trace–0.008
Cold-drawing, full cold-rolled stock	0.07–0.10	0.35–0.45	0.005–0.05	0.005–0.05	Trace–0.008
Automobile sheets	0.05–0.08	0.25–0.50	0.30 max.	See Note A	Trace–0.008
Deep-drawing stock	0.09–0.15	0.30–0.40	0.005–0.05	0.005–0.05	Trace–0.008
Extra-deep-drawing stock	0.02–0.10	0.30–0.40	0.005–0.05	0.005–0.05	Trace–0.008
Difficult drawing stock	0.02–0.08	0.30–0.40	0.005–0.05	0.005–0.05	Trace–0.008
Furniture stock	0.08–0.12	0.35–0.45	0.050–0.10	0.005–0.05	Trace–0.008
Surface important, painting, lithographing	0.05–0.08	0.25–0.50	0.005–0.05	See Note A	Trace–0.008
Vitreous enameling	0.03 max.	0.10 max.	See Note A	See Note A	Trace–0.008

Note A: Keep this element as low as possible.

Table V—APPROXIMATE PHYSICAL PROPERTIES OF COLD-ROLLED STOCK

Grade or temper	Hardness, Rockwell B	Depth of cup for 0.05 in. thickness of strip, mm.*	Ultimate tensile strength,** lb. per sq. in.	Elongation, % in 2 in. for 0.05 in. strip thickness†	Remarks
No. 1, hard	90 ± 6‡	6– 7	80,000 ±12,000	3 ± 2	Intended for flat blanking only.
No. 2 half hard	80 ± 5	7– 8	64,000 ± 8,000	9 ± 5	Intended for easy bending up to 90 deg. across the grain. No bending along the grain.
No. 3 quarter hard	69 ± 5	8– 9	54,000 ± 6,000	20 ± 7	For shallow drawing and stamping, where a very smooth surface is required. Bends 180 deg. across the grain and 90 deg. along the grain.
No. 4, soft or planished	58 ± 6	9–10½	48,000 ± 5,000	30 ± 6	For fairly deep drawing where no surface strain is permissible. Bends 180 deg. both ways of the grain.
No. 5, dead soft	45 ± 7	10–11½	44,000 ± 4,000	39 ± 6	For deep drawing where slight stretcher strains are permissible. Bends 180 deg. both ways of the grain.

* Cup depth varies with thickness of strip. For grade No. 5, the depth is given approximately by the formula: D = 10.5mm. + 6.4 log t, where t = thickness in mm. Other tempers vary in a similar way.

** Tensile properties are based on the standard tension test specimen for sheet metals, Fig. 7, A.S.T.M. Designation E8, A.S.T.M. Standards, 1936, Part 1, P. 833.

† Elongation in 2 in. varies with the thickness of strip. For Grade No. 5, the percentage elongation = 41 + 10 log t, where t = thickness in mm. Other tempers vary in a similar way.

‡ For cold strip 0.069 in. and thinner, the Rockwell B hardness range is 96 ± 6, with corresponding increase in tensile strength and drop in depth of cup test.

pickled annealed stock, except that they may be pickled last or deoxidized in box annealing to remove annealing oxide when it would be objectionable in fabricating.

7. *Extra-Smooth Hot-Rolled Annealed*—This product is identical with hot-rolled annealed stock, except that it is given a full cold-rolling to develop the desired smoothness.

8. *Blued Sheet*—Such sheets are submitted to processes designed to produce uniformly coated surfaces with light oxide films, usually having a color of some shade of blue.

9. *Specially Processed Sheet*—In addition to the above treatments, various uses to which sheets are applied require special processing. Among these may be mentioned vitreous enameling, which requires a special surface adapted for increasing the adherence of the enamel.

10. *Oiled Sheet and Strip*—These products are coated with oil to preserve them from rusting for short periods. Usually, the treatment consists of pickling, rinsing with water, washing with an alkaline solution, drying rapidly and oiling.

SURFACE TREATMENTS AND COATINGS

Iron oxides, loose dirt, oils and grease must be removed from the surface of sheets and strip steel before they can be fabricated into products. The methods and materials for cleaning and descaling sheet and strip metal are listed in Table VI.

Coating materials for sheet and strip steel are of two kinds, metallic and non-metallic. The latter is comprised of mixtures of organic or combined organic and inorganic origin. Coatings may be applied for lasting or long-time protection, but coatings that will afford temporary protection and that are easily removed or that possess properties which permit the steel to be used without their removal are important.

METALLIC COATINGS

Metals used for coating sheet and strip steel, in order of their importance include tin, zinc, terne metal, nickel, chromium, cadmium, copper, aluminum, bronze, cadmium-tin alloy, silver, gold, lead, iron and steel. These are applied to steel surfaces by the following six methods:

1. *The Hot-Dip Process*—In this process the article to be coated is immersed in a molten bath of zinc, tin or terne metal. The most suitable temperature for the molten bath is between 50 and 100 F. below that temperature at which the molten bath will attack the metal being coated or the metal from which the bath is constructed. For example, pots in which steel is galvanized will be attacked rapidly by zinc at 900 F., for which reason the best temperature of the bath has been found to be between 790 and 850 F.

2. *Surface Absorption or Metallic Cementation Processes*—Coatings of zinc, aluminum and silicon are successfully applied by these methods. They are known as sherardizing, calorizing and Ihrigizing.

In sherardizing, the parts to be coated are usually small articles which are thoroughly cleaned by pickling or sandblasting, packed in metal drums with fine zinc dust, and heated for several hours to 650 to 750 F. The drums are slowly rotated in the furnace during heating. The surface produced affords good protection against atmospheric corrosion.

In calorizing, developed by General Electric Company, thoroughly cleaned steel articles are packed in steel drums containing a mixture of alumnium and aluminum oxide. A reducing gas is passed into the drum which is rotated in a furnace and heated for about five hours to between 1,730 and 1,750 F. The aluminum coating protects the steel from oxidation at elevated temperatures.

Ihrigizing is a special type of siliconizing, or impregnating the surface of low carbon steels with silicon. The surface of the steel must be cleaned of sand and heavy scale, packed with silicon carbide or ferrosilicon, heated to 1,700-1,800 F., and exposed to the action of chlorine from two to six hours. The siliconized layer, usually 0.005 to 0.1 in. thick

Table VI—METHODS IN COMMON USE FOR CLEANING AND PICKLING

Type	*Method*	*Material used*	*Removes*	*Remarks*
Mechanical	Brushing	Steel brush	Loose dirt, rust, scale	
Mechanical	Air blast	Compressed air	Loose dirt	
Mechanical	Sand or metal blast	Sand or metal particles + compressed air	Loose dirt, rust, scale	
Mechanical	Bending or stretching		Heavy scale	
High-temperature chemical	Deoxidizing with gases	Hydrogen, methane, mixture of carbon monoxide and other gases	Thin films of oxides, organic substance, oil	Heat the material in the presence of the reducing gases. Oxides are reduced. Organic matter is decomposed.
High-temperature chemical	Liquid bath	Fused sodium carbonate + sodium cyanide	Thin films of oxides, oil, organic substance	Oxide is reduced and surface metal is nitrided, or carburized and nitrided, to form a film resistant to atmospheric corrosion.
High-temperature electrochemical	Electrolytic bath	Fused sodium hydroxide	Oxide films	NaOH is the electrolyte and the steel the cathod; use 100–150 amps. per sq. ft.
Chemical	Alkaline bath	Solutions of soaps, caustic soda, trisodium phosphate	Oil and grease	
Chemical	Liquid bath	Emulsifying solutions	Heavy oil and grease	
Chemical	Acid bath-pickling	Inorganic acids: sulphuric; hydrofluoric + nitric; phosphoric	Oxides and scale	Sulphuric acid most commonly used; sulphuric (or nitric) + hydrofluoric acids for stainless and heat-resistant steel; phosphoric acid is slow and costly, but after pickling articles are more rust resistant.
Electrolytic	Alkaline bath	Meta- or orthosilicate of soda in concentrations of 3 or 4 oz. per gal. of water	Oil	Two-step cleaning: First spray solution at 200 F. in hooded tank. Second, place in tank with electrolyte near boiling; the article is the cathode; use 10 volts, 30 amps. d.c. per sq. ft. Finally, brush and wash with water at 120 F.
Electrolytic	Acid bath-pickling	Sulphuric acid	Oxide and scale	Cowper-Coles method: Acid is electrolyte; article is cathode; lead bars for anode; direct current of 8 volts.
		Sulphuric or sulphurous acid	Oxide and scale	Reed's method: Uses acid of 1.06–1.25 specific gravity and temperature not over 140 F.; d.c., 0.4–0.7 amps. per sq. decimeter.
		Bisulphates or bisulphates + sulphuric acid	Oxide and scale	Danforth and Jones method.
		Phosphoric acid + trisodium phosphate	Oxide and scale	Marino method: Use 10% solution of acid and phosphate as electrolyte at 140 F.
		Hydrochloric or sulphuric acid	Oxide and scale	Avery method: Use 5% solution of the acids; nickel or carbon bars as anodes; direct current of 4–6 volts and 20 amps. per sq. decimeter.
		Sulphuric acid	Oxide and scale	Hanson - Van Wrinkle - Munning two-step method: First, the article is cathode in 10–20% solution of acid under 25 to 125 amps. d.c. per sq. ft. Second, article is transferred to 50% solution of acid under same current density. With d.c. of 100 amps. and solution at 90 F., low-carbon steel articles can be bright cleaned in 2 to 5 min.
Electrolytic	Acid + alkaline baths	Sulphuric acid hydrochloric acid, sodium chloride, caustic soda, trisodium phosphate	Oxide, scale, oil and grease	Bullard-Dunn process: Two electrolytes, one acid and one alkaline are used; lead anodes; article cleaned is cathode. Acid electrolyte: 3 oz. each per gal. of sulphuric acid, hydrochloric acid and sodium chloride to remove oxide and scale. Alkaline electrolyte: 3 oz. soda ash, 4 oz. trisodium phosphate, and 9 oz. caustic soda per gal. water to remove oil and grease. As scale is removed, lead film forms which is removed by reversing current quickly.

NOTE: Temperature is the most important factor in controlling the time required for cleaning, and controlling iron loss during pickling. For example, the time for pickling at 190 F. is less than half the time required at 140 F. From room temperature to boiling, the speed of pickling doubles for each rise of 15 to 20 deg. F. Also, the rate of solution of iron at 180 F. is about five times that at 140 F., and at 212 F. it is nearly 100 times that at room temperature. Therefore, the temperature should be maintained as high as possible without pitting the steel or decomposing the inhibitor, and the article should be removed from the bath as soon as it is free from scale.

NOTE: In pickling, inhibitors can be added to the bath which slows down or prevents the action of the acid upon the base metal but permits the reactions that result in removal of the oxide or scale to continue.

is hard and resistant to corrosion by non-oxidizing acids, and to wear and oxidation at temperatures to 1,600 F.

3. *Metal Spraying*—Most of the common metals can be applied to carbon sheet-metal articles by metal spraying. The metal to be coated is drawn into a wire and fed into the spray gun, where it is melted by acetylene or hydrogen flame. It is picked up and atomized by a compressed air nozzle and projected against the surface to be coated. The impact causes it to adhere to the steel surface, providing it is perfectly clean and free of oil.

4. *Copper Cladding*—In this process, the steel is cleaned perfectly, mounted on a covered mold, and heated out of contact with air to a temperature slightly above the melting point of the copper. The copper is then cast above the steel base. Other methods consist in dipping the steel core into a bath of molten copper and depositing the copper electrolytically. Semi-finished products prepared by this method may be heated to around 170 F. and hot-rolled, then finished by cold rolling or drawing as in regular copper-forming work.

5. *Aluminum Cladding*—This is accomplished by rolling flat steel almost to gage, cleaning it perfectly, placing it between two sheets of aluminum and then cold rolling. However, it may be heated to between 600 and 700 F. and rolled. The latter method results in a better bond of the aluminum with the steel Subsequent annealing above 1,000 F. causes the aluminum to unite with the iron forming a very brittle iron aluminate.

6. *Electroplating*—This is the most widely used method for applying metallic coatings to articles fabricated from sheet steel. The base metal must be cleaned of oil, grease, dirt and scale by methods such as specified in Table VI. A few typical plating baths, with operating data, are given in Table VII.

NON-METALLIC COATINGS

Non-metallic coatings are of two classes, organic and vitreous. Organic coatings are commonly known as paints, varnishes, enamels, lacquers and japans, the pigment being generally of inorganic origin. In many cases, rust inhibiting or bonding treatments are applied to effect a better bonding of the paint film with the steel surface and to inhibit corrosion effected through porosity of this film. This can be accomplished by treating the clean surface of the steel with manganese dihydrogen phosphate. Also, after cleaning, the steel can be dipped into a rust-proofing solution of copper salt and phosphoric acid, kept at a temperature of 140 F. Oxalic acid may be substituted for phosphoric acid, when the baking temperature used is below 300 F. Another inhibiting solution is chromic acid and sodium chloride which can be sprayed upon the cleaned sheet at a temperature of about 180 F. Other methods include electroplating in a zinc phosphate solution, spraying with a mixture of phosphoric acid and oxalic acid, and spraying with a solution made up of zinc nitrate, sodium bisulphate and sodium acetate. The latter is known as zincoting. It requires rinsing with water and a dilute solution of zinc chromate after spraying.

Vitreous coatings, commonly known as vitreous enamels, to distinguish them from enamels of organic origin, correspond to a layer of glass fused to the properly prepared surface of steel. The one particular requirement of such coatings is that it must have a coefficient of expansion approximating that of iron or steel. To apply these coatings, the formed sheet-metal articles are degreased, pickled in acids, rinsed in a neutralizing bath, washed, dried, immersed in a water suspension of pulverized

Table VII—TYPICAL BATHS FOR ELECTROPLATING CARBON SHEET STEEL

Kind of coating	*Type of coat*	*Typical composition of baths per gallon of water*	*Operating conditions* pH	Temperature, F.	Amperes per sq. ft.	Volts
Nickel	Watts or dull	40 oz. nickel sulphate, 8 oz. nickel chloride, 5 oz. boric acid	1 5–2 5	110–125	40	. . .
	Bright	40 oz. nickel sulphate, 6 oz. nickel chloride, 4½ oz. boric acid, + 1 or 2 per cent addition agents	2 0–5 0	125–140	10	. . . . .
	Hard	16 oz. nickel sulphate, 2.8 oz. ammonium sulphate, 1.1 oz. potassium sulphate	5 2–5 8	120–130	20–35	. . . .
Chromium	Bright	25–55 oz. chromic acid, 0.35–0.55 oz. sulphuric acid	.	110–120	150–300	3 5–6
	Hard	35–55 oz. chromic acid, 0.2–0.7 sulphuric acid	. .	140–150	200–300	. . . . .
Zinc*	Acid	32 oz. zinc sulphate, 2 oz. sodium acetate, 4 oz. aluminum sulphate, + 13 oz. addition agent (licorice)	2 5–4 0	70	25	. . .
	Cyanide	8 oz. zinc cyanide, 3 oz. sodium cyanide, 7 oz. sodium hydroxide, + ⅛ oz. brighteners (mercuric salts)	12.0–12.2	100–110	30	4–10
Cadmium		3 oz. cadmium oxide, 13 oz. sodium cyanide, + brighteners	13 0	70	25	. . . . .
Tin	Alkaline	16 oz. sodium stannate, to 4 oz. sodium hydroxide, + addition agent	. . . .	140	10–40	4.5
	Acid	8 oz. stannous sulphate, 9 oz. sulphuric acid, 7 oz. cresol sulphonic acid + addition agent	. . . .	70	35	1.1
Copper	Cyanide	3 oz. copper cyanide, 4.5 oz. sodium cyanide, 6 oz. potassium tartrate, 2 oz. sodium carbonate	11 8–12.2	160–180	30	. . . . .
	Acid	28 oz. copper sulphate, 11 oz. sulphuric acid	. . . .	70–80	30	. . . . .
Brass		3.6 oz. copper cyanide, 1.2 oz. zinc cyanide, 7.5 oz. sodium cyanide, 4 oz. sodium carbonate	11.0	110	10–12	. . . . .

* Articles electroplated with zinc may be made black in color by immersing in Antimony Black (4 oz. sodium hydroxide + ¼ oz. antimony oxide per gal. of water) or Nickel Black (4 oz. nickel chloride + 6 oz. ammonium chloride + 2 oz. sodium sulfocyanide + ½ oz. zinc chloride + ¼ oz. copper carbonate per gal. of water). These solutions should be heated to 120 F.

enamel ingredients, allowed to drain, dry, heated at 1,500–1,600 F. from 1 to 4 min., and cooled to room temperature. Additional coatings may be applied by dipping in a water suspension of pulverized enamel ingredients of the desired composition. They should be dried, and fired at 1,450–1,500 F. for one to three minutes.

Black oxide coatings are used on sheet-steel products. For such coatings, the steel is cleaned and heated to 1,200 F. for about seven hours in closed retorts in which the air is displaced by a mixture of steam and vaporized benzine, then cooled to 300 F., dipped in hot boiled linseed oil and kept at this temperature until the oil has become oxidized. The benzine helps to produce a substantial coating.

POLISHING AND BUFFING

Polishing operations are classified as (1) roughing, (2) dry fining, (3) oiling out or greasing, and (4) grease-finishing or finishing. Fused crystalline aluminum oxide abrasives are used in these operations. The recommended grain sizes for the various operations are Nos. 20 to 80 for roughing; Nos. 80 to 120 for dry fining; Nos. 120 to 180 for greasing; Nos. 180 to 280 for finishing.

For some types of work all of these polishing operations may be successively performed on various articles, while for others only one or two may be necessary to produce the required surface characteristics. For example, when preparing products for paint or lacquer finishing, Nos. 80 to 150 abrasives can be used, but when they are to be plated all four polishing operations may have to be used.

The most common type of polishing wheel is made up of woven cotton fabric, sewed or stitched together and then screwed or cemented to form a wheel of the desired thickness and density. Wheels are made of canvas belting, woven cloth, sheepskin, sewed buck, wool felt, leather, walrus hide wood blocks. Walrus hide is tough and springy, and can be cleaned by soaking in solvent if used for oiling out or greasing operations. Fine cloth, sheepskin and wool-felt wheels are used for certain dry fining operations and greasing work. Leather-covered wood wheels are frequently used for polishing flat work where a slight cushion with a solid backing is required. For polishing flat sheets or pieces, abrasive belts can be used instead of wheels.

The density, that is, the resiliency, of the polishing wheel is determined by the sewing of the buff sections and by the extent of the area of the buff that is glued. Buff sections in which the rows of concentric or spiral sewing are spaced closely, say ¼ in. apart and which are glued to the buff, form the densest type of cloth wheel. Wheels of lesser density can be made of sections with wider spaced sewing, say from ⅜ up to ¾ in., the glue being stopped between 1 to 4 in. from the periphery of the wheel. A wheel that is not glued up to its periphery, however, has a tendency to separate between the buff sections and to leave streaks on the surface of the work being polished.

The density of polishing wheels can be varied over a wide range by varying the number of blocks of material that are assembled into the wheel. The cushion, that is, the distance that the material projects beyond the side plate of the wheel, also can be varied within certain limits. A cushion of 2 in. is most commonly used, but a 3 in. cushion is used where a particularly yielding wheel is desired, and a 1 in. cushion where the wheel is required to be rigid. Polishing wheels can be made with formed bases to fit the contour of the work being polished.

All polishing wheels should be carefully balanced. Unbalanced wheels produce poor work and have short life; also, they increase the cost of production because extra effort is required to produce good work. Best polishing results are obtained at wheel speeds of 7,500-8,500 surface ft. per min.

For best polishing results, the following points should be observed:

1. The abrasive grain should be accurately graded, clean and uniform in size, shape and grain surface.

2. Use a first quality animal hide glue for assembling wheels.

3. Weigh the glue and cold water carefully before soaking. Proportions of glue and water for the various grain sizes are as follows: For 150–200, 25 per cent of dry glue by weight; No. 100–120, 33 per cent; No. 80–90 grain, 35 per cent; No. 60–70 grain, 40 per cent; No. 46–54, 45 per cent; No. 30–36, 50 per cent.

4. Keep the glue no higher than 150 F.

5. Keep the glue pot, brushes and abrasive clean, free from oil and foreign matter.

6. The abrasive grain and wheels should be heated to about 120 F. before applying the glue.

7. Apply the glue evenly to the surface of the wheel, then roll the wheel in the grain, pressing firmly and evenly so that the grain will be uniformly coated on the wheel.

8. Place the coated wheels in a special drying room, preferably where a constant temperature of 70 F. and a relative humidity of about 50 per cent can be maintained. Allow the wheels to remain until thoroughly dry.

Narrow ledges, corners and other places difficult to reach with the polishing wheel are bound to be poorly finished and may ruin the appearance of the part or article. In such places polishing compounds accumulate and become compact, causing difficulties in subsequent cleaning and plating operations. When designing parts which are to be polished, plated and buffed, designers should keep these facts in mind.

Rough polishing will oxidize the surface of the metal, since the action of the abrasive is of considerable violence and pressure. Blue-colored spots resulting from the heat remain on the polished article after cooling. They are likely to show under paint or lacquer unless greasing or finishing operations are employed.

Some fabricators of sheet-metal products are using satin-finished sheet and strip steel, which eliminates roughing, dry fining and grease polishing operations. However, during forming operations, this satin-finished steel may receive surface markings which can be removed by polishing with abrasives of No. 200–220 grain.

Operators in plants forming articles from satin-finished steel should be trained to the hazards caused by rough handling, scratching and damaging the surface of this steel, especially when the parts are to be eventually plated and buffed. Scratches and die marks are detrimental and cause extra work in polishing; then the expense involved may not justify the high cost of such steel.

After polishing, parts must be degreased for plating or finishing with organic material. Degreasing methods are listed in Table VI.

Not all articles made from carbon

flat-rolled stock need be polished as described above prior to plating. After press-forming (greasing and pickling when necessary), small articles can be burnished with hard-steel balls using trisodium phosphate and soap chips. The length of burnishing operation depends upon the finish desired. Care must be taken so as not to roll over sharp edges on the piece. Often, when there is a sharp edge, this should be removed by emery or sand paper prior to burnishing. Such burnishing is more economical than polishing, and articles properly burnished are capable of receiving a bright nickel or chromium plate, the quality of which on small parts is comparable to that produced on larger parts which have been polished and buffed.

Buffing sheet-metal articles is bound to produce a sheen or luster on the surface. It comprises two operations, cutting down and coloring. The work is performed with a buffing wheel composed of a number of circular cloth disks mounted on an arbor and rotated at speeds ranging from 7,500 to 8,500 surface ft. per min. The wheels are of three types, full-disk buffs, which may be either loose or sewed; sewed-piece buffs, and patented folded buffs. The material is usually cotton sheeting, bleached or unbleached, the most widely used grade having a wrap of 64 threads per inch and a filling of 68 threads, known as 64 x 68 cloth. Another widely used fabric is woven 84 x 92 cloth, which is harder than the 64 x 68 cloth and will stand rougher usage. They are used for cutting down operations, while the 64 x 68 is generally used for coloring. Folded buff consists of full disks folded and assembled in various ways to form pockets, and then are assembled to form a complete circle after which they are either sewed as a loose buff or as a spirally sewed buff. Such buffs are used for both cutting down and coloring. Their use usually results in the elimination of buff marks found with the full-disk or sewed-piece buffs.

Buffs operating under heavy pressure must be ventilated in order to dissipate the heat generated. Folded buffs are designed to provide their own ventilation. Full-disk and sewed-piece buffs may be ventilated by assembling one or two disks of smaller diameter than the buff disk between each pair of buff disks or at such intervals as may be necessary, depending upon the severity of the work.

WELDING

Sheet metal may be butt, flange or lap welded. To obtain consistently a welded seam of good quality, the edges of the sheet-metal members must be well aligned. All dirt, rust, and scale should be removed.

Butt welds usually have additional metal supplied in the form of welding rods. The flanged joint is usually preferred for gas-welding on sheet lighter than 20 gage. The edges are flanged, brought together, and fused down; welding rod is seldom used. Particular care should be taken to secure good penetration and eliminate the film of oxide between the projecting edges.

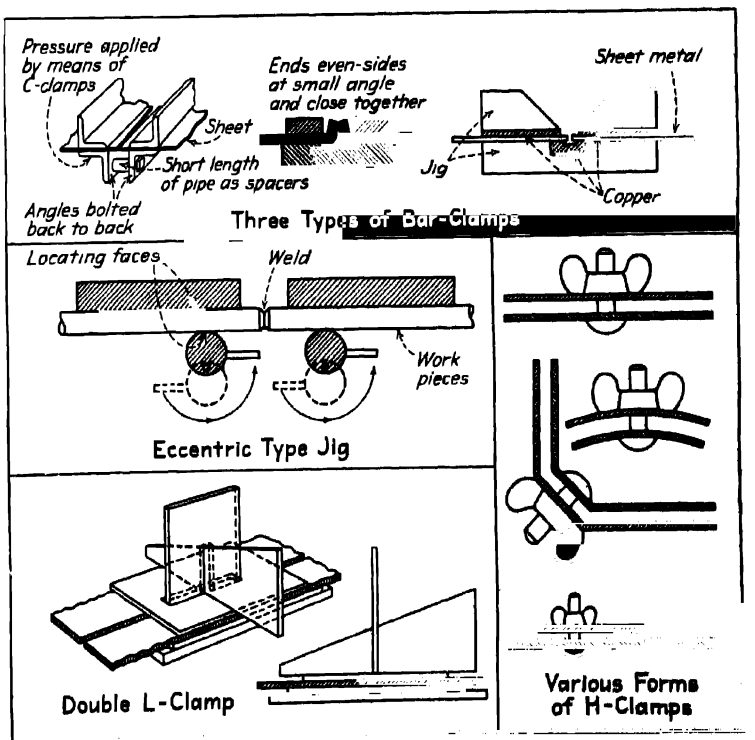
Buckling and bulging, caused by expansion and contraction of the metal resulting from the heat of the welding operation, is the biggest problem in welding sheet steel. Properly designed jigs will prevent such buckling and restrict movement of the sheet. They aid in assembling the various sheet members and in aligning the edges to be joined.

Stagger welding will relieve buckling by evenly distributing the heat over the full length of the seam. In this procedure, the welder welds a few inches at the beginning of the seam, then moves to the center, next to the end of the seam, and finally back to where the first weld ended, repeating the cycle until the weld is completed.

Beading is employed as a means of allowing for expansion and contraction in light sheet. Before the parts are aligned for welding, a bead is run along the sheet parallel to the seam and not more than an inch from the edge. The bead acts as an expansion joint, taking up movement that occurs due to the heat of the operation.

Because of buckling, it is generally advisable to locate a weld at or near a square or rounded corner. Although a corner weld may not decrease the magnitude of the stresses developed, it will restrain the tendency of these stresses to cause buckling. Two sheet-metal members, being in different planes, will act as stiffeners, and oppose deformation in the other plane.

The space allowance between sheets for welding will vary directly with the thickness of the sheet and also



Sheet metal should be securely jigged for welding in order to limit distortion and increase production. The jigs shown embody a number of usual design principles

Table VIII—TYPICAL REQUIREMENTS FOR VARIOUS TYPE WELDS

Gage No.	Electrode size, in.	Position of weld	Butt Amps.	Butt Volts	Lap Amps.	Lap Volts	Fillet Amps.	Fillet Volts	Corner Amps.	Corner Volts	Edge Amps.	Edge Volts
20	3/32	Flat	30*	18	40*	21	...	.	40*	21	40*	21
		Vertical	30*	18	40*	21	...	...	40*	21	40*	21
		Overhead	30*	18	40*	21	...	. .	40*	21	40*	21
18	3/32	Flat	40*	18	60*	22	40*	21	60*	24	60*	23
		Vertical	40*	18	60*	22	40*	21	60*	24	60*	23
		Overhead	40*	18	60*	22	40*	21	60*	24	60*	23
16	1/8	Flat	70*	29	100	25	70*	27	90*	24	80*	25
		Vertical	70*	29	100	25	70*	27	90*	24	80*	25
		Overhead	70*	29	100	25	70*	27	90*	24	80*	25
14	1/8–5/32	Flat	85*	29	130	25	100	25	90	24	110	27
		Vertical	80	29	130	25	90	24	80	28	80	26
		Overhead	85*	29	130	25	85	24	75	25	80	26
12	5/32	Flat	115	25	135	25	150	25	125	24	145	28
		Vertical	110	26	120	26	140	24	110	28	110	26
		Overhead	110	25	120	25	120	24	110	26	110	26
10	5/32–3/16	Flat	135	25	155	28	160	25	140	24	150	28
		Vertical	120	27	130	26	150	24	130	28	120	27
		Overhead	115	25	120	25	130	24	125	26	120	26
8	5/32–3/16	Flat	190	27	165	28	160	25	175	27	160	28
		Vertical	130	27	140	26	160	24	130	28	120	27
		Overhead	120	26	120	25	130	24	125	26	120	27

* Electrode negative and work positive. Electrodes designed especially for thin sheet should be used.

the length of the seam. A good rule-of-the-thumb is to allow a spacing equal to the thickness of the sheet for every foot of weld length. By welding as rapidly as possible, that is, as fast as good welding will permit, the sheet movement and the space allowance between sheets are held to a minimum.

GAS WELDING

In gas welding, the tip should be held at such an angle that the molten metal is not forced ahead of the flame on relatively cool and unfused edges of the sheet. It is a common fault of the welder to hold his tip too nearly parallel to the surface, thus blowing the fluid metal on to sheet edges which are not hot enough to receive it. On the other hand, if the welding torch is held too nearly vertical, it will be difficult to avoid burning holes through the sheet. Metal from the welding rod must flow into the area under the welding flame, and only at the point where the base metal is actually liquid. The quantity of rod added should be regulated so that there will be no tendency for the metal to flow ahead of the welding, resulting in adhesion rather than fusion. The soundness of the weld is dependent upon using the proper blowpipe, tip, gas pressures, and proper size of welding rod.

The strength of a welded sheet is dependent upon thorough penetration. The margin between correct and excess of heat is relatively slight in gas-welding light sheets, and the endeavor to weld through to the under side of the sheet should, therefore, be regulated so that the molten metal will not be lost through the bottom of the weld If penetration extends through the sheet, grinding or filing will remove most of the irregularities.

ARC WELDING

When welding thin sheet with the electric arc, an electrode having low spatter and slag loss, depositing metal of high quality, should be used. The electrode should usually be negative and a short arc should be used to eliminate tendency for the electrode to stick. Proper current characteristics for welding thin sheet are easily obtained with a 75 to 100-amp. unit. When welding with a higher capacity generator, such as 300 amp., it may be necessary to insert a resistance of approximately one ohm in series with the arc to reduce the current to the desired value. The highest open circuit voltage at which the required welding can be maintained is recommended. Data for electric welding are given in Table VIII.

The physical properties of welds on low-carbon sheet range from 35,000 per sq. in. with bare electrodes to 65,000 lb. per sq. in. with shielded arc electrodes. Elongation of welded sheet using bare electrodes seldom exceeds seven per cent in 2 in., whereas with shielded-arc high-speed electrodes the elongation may be as high as 25 per cent in 2 in.

SPOT WELDING

Practically all rolled or drawn sheets can be successfully spot welded, except tin plate, which deteriorates rapidly after welding. Low-carbon sheet steel, when clean, can be spot-welded with one current impulse; however, should the sheet be scaly, rusty, or heavily coated, a second impulse may be required without releasing the pressure at the die point.

Spot welds in low-carbon sheet steel may be separated by at least the diameter of the spot or point. However, wider separation is recommended because when spaced so close, the spot already made steals part of the current from the next spot attempted, thus causing bad welds. Whenever possible, spots should be placed from ¾ in. to 1 in. apart on centers on light and medium gage stock. Data pertinent to spot welding are given in Tables IX and X.

Table IX—PRESSURES USED IN SPOT WELDERS

Diameters, in. Die point	Diameters, in. Welded spot	Area of spot, sq. in.	Sheet thickness, in.	Allowable load, lb. per spot Dynamic*	Allowable load, lb. per spot Static**
1/8	0 10	0 0078	0 03	31	70
1/4	0 15	0 0178	0 05	71	158
3/8	0 25	0 049	0 08	196	441
1/2	0 35	0 096	0 12	384	864

* Based on 4000 lb. per sq. in.
** Based on 9000 lb. per sq. in.

Table X—WELDING CAPACITY OF SPOT WELDERS *

Sheet gage No.	Electrode diameter, in.	Horn diameter, in.	Capacity, Kva
30–18	7/8	1 3/4	7 1/2
30–16	7/8	1 3/4	10
26–14	1	2	15
26–12	1	2 1/4	20
24–11	1 1/4	2 1/2	30
22–10	1 1/4	2 1/2	40
20– 8	1 1/4	2 3/4	50
20– 6	1 1/4	2 3/4	60
20– 5	1 1/4	2 3/4	75
18– 4	1 1/4	3	100
18– 2	1 1/2	3	125
16– 1	1 1/2	3	150

* With 12-in. throat depth; welding two pieces of stock.

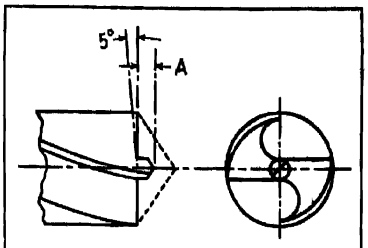
NOTE: The values in this table are conservative, and heavier work can be done on each rated welder when necessary.

COLD-WORKING AND MACHINING

The cold-working of sheet steel requires the use of powerful machines to change the shape, contour or cross-section of the initial shape. It involves mechanical and hydraulic presses for stamping, drawing, bending, and flanging; also equipment for rolling, knurling, curling, seaming, profiling and shearing.

Cold-working causes cumulative strain-hardening with a progressively increasing yield point. After severe strain-hardening in one or a series of operations, the metal must be annealed before further cold-working can be done. If the design of the piece provides for an intermediate annealing operation, the critical range of 1,290 to 1,650 F. should be avoided because grain growth and breakage may occur in the next drawing operation. Annealing temperatures between 900 and 1,000 F. may overcome these difficulties. If not, annealing temperatures not less than 1,650 F. should produce a satisfactory structure.

Cold-rolled sheet steel is recommended for drawing operations.



Size of Drill, In.	Dimension A, in.
5/16 to 5/8	1/8
5/8 to 1 1/8	3/16
Over 1 1/8	1/4

Drills with included point angles of 135–160 deg. have less tendency to cause burrs when drilling sheet steel. Pilot-pointed drills here shown, produce holes that are not out-of-round

Double bends and bends across the grain can be made with specially tempered sheet as noted in Table V.

When there are two right-angles formed at right angles to each other, they should be laid out as near to 45 deg. to the grain as possible. Avoid having forms at an angle of less than 30 deg. to the grain. For parts with low-production quotas, the form of the part instead of the die can be favored in layout and design; the stock waste, although large on each piece, is small compared to the expense of a very costly tool. The reverse holds true for parts made on a high-production basis.

Deep-drawing sheet steels are susceptible to fluting and the development of stretcher strains. Such difficulties can be reduced and in some cases eliminated by roller leveling prior to forming.

The common single-action press may be fitted for the easier drawing operations by adding spring or rubber-pressure attachments, or by using pneumatic die cushions. For more severe draws, shallow stretchings, and for power economy, double-action presses should be used. Triple-action presses permit combined drawing and redrawing at one handling.

In drawing rectangular shells, the

Table XI—FORMULAS USED FOR COLD-WORKING CARBON SHEET STEEL

Flat rolling:	
Area of rolls	$A = w\sqrt{R\,(t_1 - t)\,2}$
Rolling pressure	$P = 3.2\,S_r\,A$
Bending:	
Length of radii, Fig. A	$L = (r + 0.4t)\,(2\,\pi\,B^2/360)$
Length of stock, Fig. A	$L_1 = X + L_1 + Y + L_2 + Z$
Punch pressure, V-bends, Fig. B*	$P = (C\,S_u\,w\,t^2)/V$
Punch pressure, U-bends, Fig. C	$P = \frac{2}{3}\,S_u\,w\,t\,(1 + t/V)$
Bottom-pad pressure, U-bends, Fig. C	$P_1 = \frac{2}{3}\,(S_u\,w\,t^2)/V$
Pressure in roll bending	$P = 12d\,E\,w\,t_3$
Blanking:	
Blanking pressure, flat tools	$P = l_s\,t\,S_s$
Blanking pressure, sheared tools, Fig. D	$P = (l_s\,t^2\,S_s\,p)/s$
Blank diameters for drawing shells	$D = \sqrt{D_m^2 + D_m h}$
Work done in blanking	$W_b = (P\,t\,p)/2000$
Drawing:	
Limit drawing pressure, rectangular shell**	$P_{max} = l_d\,t\,S_u$
Limit drawing pressure, round shell**	$P_{max} = \pi\,D_m\,t\,S_u$
Pressure for shallow draws	$P = \pi\,D_m\,t\,S_u\,[(D/D_m) - 1.3]$
Stretching pressures, Fig. E	$P = l_s\,S_u \sin a$

* This formula makes no allowance for spring back; increase the pressure to minimize spring back.

** Loads obtained with these formulas are those necessary to punch the bottom out of the shell.

Nomenclature

P = downward pressure, lb.; P_1 = upward pressure of punch pad, lb.; A = roll contact area, sq. in.; R = radius of roll, in.; w = width of sheet, in.; t = thickness of sheet after flat rolling, in.; t_1 = thickness of sheet before rolling, in.; S_y = yield strength of sheet, lb. per sq. in.; S_u = ultimate strength of sheet, lb. per sq. in.; S_s = shear strength of sheet, lb. per sq. in.; L = mean length of a given bend.; L_1 = total length of sheet for making bends, in.; r = radius of bend, in.; B = angle of bend, deg.; X, Y, Z = length of tangents adjacent to bends, in.; V = width of die for making bends, in.; C = constant for calculating bending pressures — $C = 1.33$ when $V = 8t$, $= 1.24t$ when $V = 12t = 1.2$ when $V = 16t$; E = modulus of elasticity, lb. per sq. in.; d = deflection of rolls in bending, in.; l_d = length of periphery of rectangular drawn work, in.; l_s = length of periphery of punch for shear cuts = length of four sides in rectangular work = $\pi \times$ diameter of punch for round work, in.; l_s = length of periphery of punch for stretching, in.; s = shear of punching tool, in., see Fig. D; p = shear penetration, per cent = 38 per cent for low-carbon steel; D = blank diameter, in.; D_m = mean diameter of drawn shell, in.; W_b = work done in blanking, inch-tons; W_d = work done in drawing operations, inch-tons; h = height of drawn shell, in.; a = angle stretching punch makes with die, deg., see Fig. E.

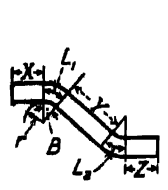


FIG. A

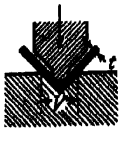


FIG. B

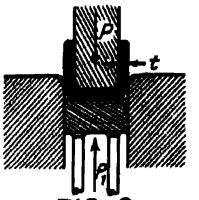


FIG. C

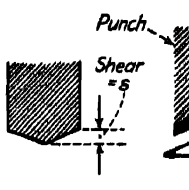


FIG. D

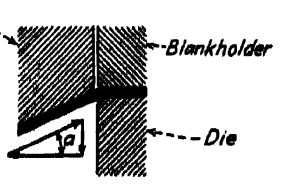
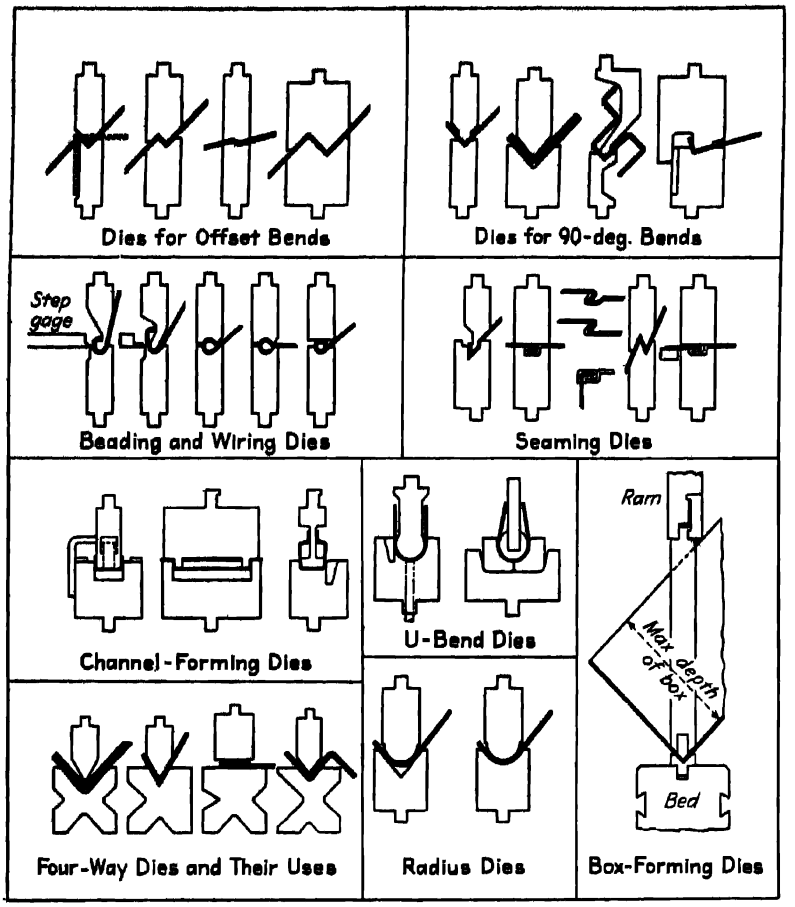


FIG. E



These typical single-purpose and combination dies are the simplest and most economical to build and use for bending sheet metal

limit depth per operation is about four to six times the corner radius, because of the distribution of surplus metal from the corner area into the adjacent wall area. The drawing pressure is relatively lower than for round work. The allowance for blank holding may run as high as 100 per cent of the drawing pressure, depending on the severity of the draw.

In stretching shallow shapes, the metal may be gripped tightly around the edge. The blank-holding pressure is two or three times the relatively low-drawing pressure.

The pressure required to hold the blank flat while deep-drawing round work varies from zero for relatively thick blanks, up to a third or a half of the drawing pressure. When the blank-holding pressure, exceeds a third of the drawing pressure, it is best to use draw beads to permit the blank-holding pressure to be decreased.

Mechanical grip on the edges of blanks, as obtained in toggle and cam presses is, for practical purposes, positive and non-yielding. It is desirable for domed and tapered shallow shapes and for shallow stretching, especially where draw beads must be stamped to help grip the metal.

Rubber bumper pressures may be approximated at 10 lb. per sq. in. of area per one per cent of compression More uniform pressures and more convenient control of pressures are obtained with die cushions. Pneumatic die cushions may be selected on a basis of 100 lb. per sq. in. of piston area, maximum; hydro-pneumatic cushions for drawing purposes can be selected on a basis of about 500 lb per sq. in.

The total per cent reduction accomplished between annealing operations, whether in one or more operations, should be kept within the percentage of reduction in area established by tensile tests of the properly annealed material.

Formulas for calculating various factors in cold-forming operations on sheet steel are listed in Table XI.

The steel used in forming dies depends upon two factors; the length of run expected from the die, and whether the die is of simple or intricate design. For example, where short runs are anticipated, a carbon-vanadium water-hardening tool steel may be used. For dies of intricate design or in those intended for long runs, a manganese oil-hardening steel can be used. Die steel data are given in Table XII.

Cemented-carbide die inserts are being used successfully for some drawing operations. For example in making ferrules for stove pipe dampers, using cold-rolled strip steel 0.02 in. thick to form a cup $\frac{3}{4}$ in. outside diameter by $\frac{1}{4}$ in. high, a cemented-carbide die produced between 12,000,000 and 14,000,000 pieces per refinish of the die insert. This approximates four years' service. These parts were produced with little or no trouble from galling.

BENDING AND SHEARING

The most common operating speeds of bending presses is 20 to 30 strokes per minute, although presses are built with two-speed arrangements, the lower of which is usually ten strokes per minute and is used to avoid reverse bends when working long sheets. Reverse bends are caused by whipping of sheets when the work is done too fast. High speeds up to 90 strokes per min. can be used for punching operations.

A great variety of bends may be formed as shown in one of the illustrations.

Special steel dies can be used for making bends with sharp corners, or where considerable tonnages are required, or where there are a sufficient number of pieces to warrant the cost. However, a single set of one-purpose dies is costly. A one-die set-up with a variety of inserts will keep down the cost.

Large sheets are cut to shape in squaring or "gate" shears, which are essentially a single-purpose modification of the gap-frame, double-crank power press, arranged with a set of shear blades, a hold down to clamp the metal while cutting it, and a set of gages to assist in locating the cut. Circle-cutting shears, rotary splitting shears, and gang-splitting machines for two or more parallel cuts, exert working pressure localized on a small area at the point or line of contact between rolls and the work; since the work is progressive, a continuous and more or less uniform supply of power must be maintained.

Beading, flanging, knurling, curling, and double seaming, as well as other rotary cold-forming operations are performed on a variety of machines from simple parallel-shafts, hand-served types, to multiple-spindle, chute-feed and high-speed production automatics.

DRAWING COMPOUNDS

The better drawing compounds consist of a concentrated-base product which is capable of high dilution with water or oil or both. Saponifiable oils and fats, such as palm oil, seed oils, including cottonseed and rapeseed, animal oils and fats, such as beef and mutton tallow and lard oil, together with fish oils, sperm oil are all used to formulate the base. They are either saponified with caustic soda or potash, or are made into an emulsion.

Saponifiable materials are sometimes added to the make-up of a compound in a sulphonated form, such as sulphonated castor, sulphonated tallow or sulphonated sperm. Mineral oils may be added to the compound to provide lubricity. These oils are sometimes chlorinated in order to build up their extreme pressure film strength.

Pigments, such as whiting lithopone, talc, and soapstone, are added to the compound to act as a mechanical "spacer" or separator and to prevent scoring and seizing where the die pressure on the work piece is high and which tends to break through the compound's lubricating film. The pigment helps to prevent seizure.

Blanking and punching requires no expensive lubricant. Straight mineral oils or soluble oils, highly diluted, are usually satisfactory for such operations.

Forming operations, where the sheet is merely bent or stretched slightly, requires no lubricant.

Drawing operations which are more severe require carefully compounded products. Depending upon the finishing operations to follow drawing, the compound may be made up of saponifiable material, mineral oil, pigment and water.

When a degreaser is used to clean the stampings, the soap content is kept to a minimum. Pigments are also held to a small percentage or eliminated entirely due to sludge accumulation in the degreaser tank.

Work to be vitreous enameled must be drawn with a non-pigmented compound, keeping the unsaponifiable content very low. Inclusion of the inert material of the compound in the "pores" of the steel during the flow of metal in the die operation, results in defective enamelware after the parts are baked under high heat.

On multiple-station, fast-production working of low carbon steel a drawing oil is usually used. This may be either emulsifiable or non-emulsifiable. Chlorinated paraffine, various grades of straight mineral oil, sulphurized oils, saponifiable oils are usually included in this base product.

In determining the type of drawing compound needed to smooth the flow of steel, it is necessary to learn the type of metal to be worked, the kind of dies used, the production speed, the method of cleaning and type of finishing to follow the operation, before the proper type of drawing compound may be recommended for any particular job. Although any one of several types of compounds might work in the drawing operation itself, the cost of cleaning and finishing might prove to be too high where certain compounds have been used.

DRILLING AND TAPPING

When drilling $\frac{1}{16}$ to $\frac{5}{16}$ in. holes in carbon sheet steel, high-speed drills, designed with a shorter twist cut and heavier web than used on a regular drill, are recommended to avoid breakage. The included point angle for small drills can be 118 deg., with 10- to 12-deg. lip clearance.

When drilling large holes, included point angles of 135–160 deg. are recommended to prevent the drill from pushing through the sheet and causing a burr on the back side of the sheet. Drills with large point angles cannot always be started easily on a flat surface, and this condition sometimes makes it advisable to use a smaller point angle, even though a larger burr is produced. Some drill manufacturers recommend thinning the web on large drills for sheet metal work, since this reduces the pressure needed to force the drill through the work.

"Hogging in" when breaking through a hole is caused by the screw action of the right-hand spiral pulling the drill through the material. In order to curtail this tendency, the spiral angle at the cutting edge of the drill can be reduced. This is accomplished by grinding a flat along the cutting edge at the drill point, thus reducing the rake angle.

It is often difficult to drill a round hole in sheet steel. This can be partially or entirely eliminated by using what is known as a "modified" spur or pilot point, that is, a drill with the spur in the center of the tool, similar to a wood bit, but without lip at the periphery. When grinding such a drill, the spur should be exactly in the center. With such drills, the web

Table XII—COMPOSITION AND HEAT-TREATMENT OF TOOLS FOR COLD WORKING CARBON STEEL †

Steel No.	Tool	Elements, per cent C	Mn	Si	W	Cr	V	Mo
1	Dies and punches	0.84	....	....	.....	.. ..	.....	.....
2	Dies and punches	1.10	...	....	.....	.....	Opt.	.....
3	Dies and punches*	0.90	1.10	....	0.50	0.50	0.20opt.	.....
4	Dies and punches*	0.90	1.60	....	.. ..	....	.....	.. ..
5	Dies and punches*	1.15	0.30	....	1.60	0.50	0.20	.....
6	Punches	0.50	. ..	....	2.00	1.25	0.25	.....
7	Punches	0.55	0.80	2.00	.....	0.50max.	0.25max.	0.30max.
8	Punches	0.50	0.40	1.00	...	.....	.. . ..	0.50
9	Shears, dies and punches	0.70	....	...	18.00	4.00	1.00	.. . ...
10	Shears, dies and punches	2.10	....	....	.....	12.00	.....	.. ....
11	Shears, dies and punches	1.50	....	....	.....	12.00	.....	0.75

HEAT-TREATMENT

Steel No.	Preheat temp. F.	Rate of heating for hardening	Hardening temp. F.	Time at heat, min.	Quench medium	Temper temp. F.
1	.....	Slow	1400–1450	10–30	B or W	350–550
2	.....	Slow	1400–1475	10–30	B of W	350–550
3	1200	Very slow	1450–1500	Note A	O	325–500
4	1200	Very slow	1400–1475	Note B	O	325–500
5	1300	Very slow	1575–1625	Note A	O	350–550
6	.....	Slow to 1400	1650–1750	10–30	O	500–650
7	.....	Slow	1575–1675	10–30	B or W	350–700
8	.....	Slow	1525–1575	10–30	B or W	350–700
9**	1450–1600	Rapid from preheat	2200–2300	Note B	A or O	1050–1200
10	1500	Very slow	1800–1875	15–45	A(still)	400–1000
11	1500	Very slow	1700–1800	15–45	O	400–1000

Only type analyses are given.

Note A: To obtain maximum hardness hold at heat up to ½ hr. For minimum change in dimensions, do not hold at heat.

Note B: Do not soak.

* Recommended for non-shrinkable tools.

** May be pack hardened at 1950–2200 F. and tempered at 1050–1200 F., and quenched in oil or air; also, pack hardened at 1850–2000 F., tempered at 500–900 F., and oil quenched. In both cases, do not hold at hardening temperature any longer than is necessary to assure that the die has reached the desired dimensions.

Quenching media: A = air, B = brine, W = water, O = oil.

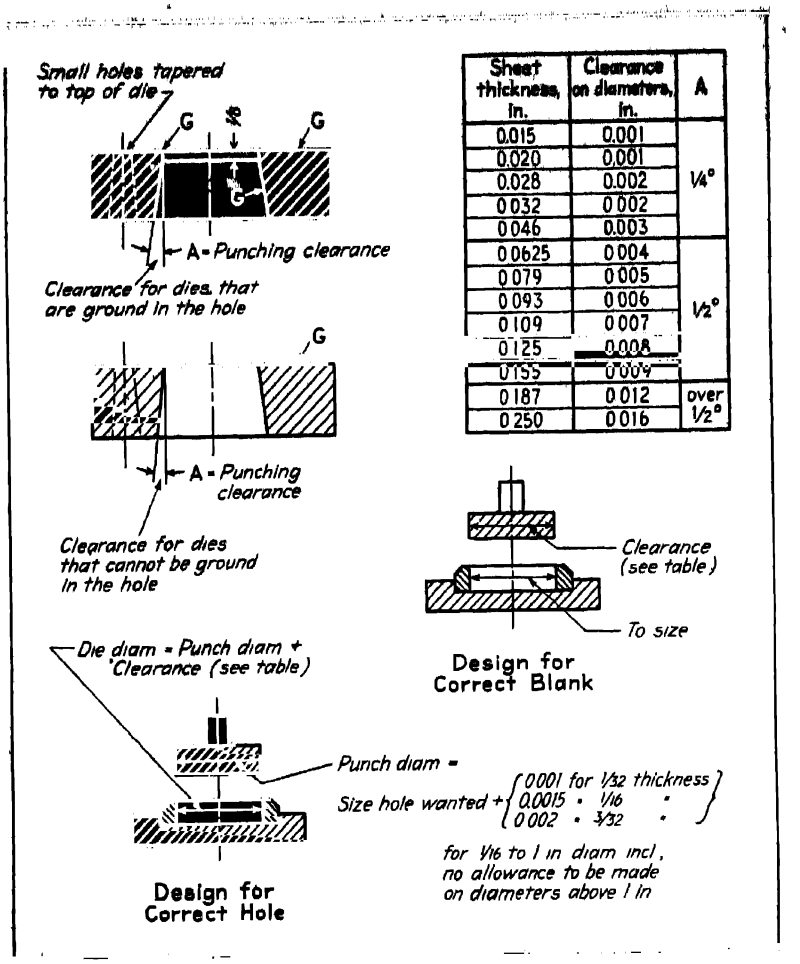
at the point should be thinned to about half the regular thickness. Another method for drilling round holes and elimination burrs is the use of a combination drill having two diameters. The large diameter tends to remove any burr which the small diameter may cause, without causing any of its own. The difference in diameters need to be only enough to clean up the burr or any out-of-round condition.

Success of drilling sheet metal in general is dependent upon solid support. Clamps should be used close to where the hole is to be drilled.

Drilling speeds in low-carbon sheet-steel range from 60 to 100 surface ft. per min. Soluble oil is the most generally recommended lubricant.

Reaming of holes in sheet steel is best performed at 60 to 80 surface ft. per min. Feeds for machine reaming of sheets in stacks should be two or three times the corresponding drill speed. For reamers smaller than $\frac{1}{8}$ in., machine feeds should be 0.002–0.004 in. per revolution for $\frac{1}{8}$- to $\frac{1}{4}$-in. reamers the feed should be 0.004–0.008 in. per revolution. For larger reamers use feeds up to 0 003 in. per revolution. Many holes in sheet steel are reamed with pneumatic and electric tools held by the operator, in which case the reamer should be advanced slowly to prevent reamer wear and scoring of the hole.

For threading through holes in sheet steel, high-speed ground-thread spiral pointed taps will produce satisfactory results. Recommended speeds are 30–40 surface ft. per min., using sulphur base oil as a lubricant



Sheet thickness, in.	Clearance on diameters, in.	A
0.015	0.001	
0.020	0.001	
0.028	0.002	1/4°
0 032	0 002	
0 046	0.003	
0 0625	0 004	
0 079	0 005	
0 093	0 006	1/2°
0 109	0 007	
0 125	0.008	
0 155	0 009	
0 187	0 012	over 1/2°
0 250	0 016	

Rough and torn edges can be avoided when punching or blanking thin sheet by adopting precise clearances for the punch and die These clearances are used most commonly

SAWING

Carbon sheet steel is easily sawed in both single and multiple sheets on metal band saws. When stacking this material for multiple sawing, height is usually limited to 8 in. There are several methods of holding the sheets together. One is to braze or weld the pieces together. Another is to hold the pieces to a $\frac{1}{4}$-in. plate, using studs screwed into tapped holes in the plate.

When sawing single or stacked sheets, longer saw life can be expected from cold-rolled sheets than from hot-rolled sheets. For 30–16 gage sheet, use a 32-pitch, wave-set saw at 500-1,500 surface ft. per min. For 16–8 gage sheet, use 24-pitch raker- or wave-set saws running at 300–500 surface ft. per min. For 8 gage to 1 in. stock, use 18-pitch raker-set saws at 250-300 surface ft. per min. Carbon sheet steel is sawed without coolant or lubricant of any kind, the heat generated being dissipated as the saw travels around the carrier wheels.

The width of the bandsaw will be determined by the contour to be sawed. Narrow bandsaws will not withstand as high tooth pressures as wide saws; consequently, the cutting time is somewhat higher. All saws for cutting carbon sheet steel should have a hard temper.

Laminated sheet steel can be cut with circular saws, providing a fine pitch blade is used. In general, the pitch of the blade should not exceed the thickness of the metal being cut

Although machining of sheet steel is not practiced extensively, some single sheets in the thicker sizes, as well as laminated thin sheets can be either bored or the edges cut parallel with or perpendicular to the length of the sheet. Round-nose tools are most often used, especially with laminated sheets, since they have less tendency to "hog in." Width of the tools seldom exceeds $\frac{5}{8}$ in., with narrower sizes being preferred. The nose radius for $\frac{1}{4}$-in. tools should be 0.072 in., while that for $\frac{5}{8}$-in tools should be 0.026 in. Tools of high-speed steel predominate for cutting low-carbon sheet steel.

Recommended angles for roughing tools are: back rake 6–10 deg.; side rake, 14–22 deg., side relief, 5–9 deg.; and end relief, 5–9 deg. For finishing tools use 14–22 back rake, 5–9 deg end relief, and no side rake or side relief.

Rough cutting thin sheets is not recommended unless they are laminated in tightly compressed stacks Even then, the roughing cut is likely to leave tool marks and result in tearing the edges of the sheets. Hence, light cuts and fine feeds are most frequently used. As a rule, cuts do not exceed $\frac{1}{32}$ in., while feeds are held below 0.002 in.

Lubricants used are sulphurized mineral oil, 40-to-1 soluble oil, and water with 1½ per cent borax or soda.

Heat-Treating Troubles and Their Correction

BY R B SEGER SHOP SUPERINTENDENT THE LINDBERG STEEL TREATING COMPANY

WHEN A PIECE of steel is to be heat treated, there are precautions which the heat-treater can observe to produce the best job Elements of design removal of mill scale, surface conditions, and similar factors are beyond his control unless consulted before the part is made Incidentally, for best results the toolmaker should never hesitate to call upon the heat treater for advice on heating data

Heating rate, temperature control, quenching media and method, furnace atmosphere, and tempering procedure are the tools which the heat treater has to use To insure proper control of these tools, it is essential that the composition of the steel be accurately known Hardening on the bases of a spark test is foolhardy at best, and may result in considerable expense and valuable lost time

The more common defects occurring during heat treatment are (1) cracking, (2) warpage, (3) soft spots, (4) size change, and (5) spalling A review of the following tabulations will show that the toolmaker may do much to aid the heat treater in producing a perfect article

CRACKING

CAUSE	METHODS OF CORRECTION
Design	Always allow as liberal a fillet as possible in corners The more generous the fillet the less chance of a corner being a starting point for failure Avoid the junction of thin and heavy sections two pieces are better than one if the sections vary in mass
Underheating, non-uniform, and too rapid heating	Use a double preheat of 600 F. and 1200 F on all steels with the exception of those which harden at the higher temperatures such as hot work, high speed and high carbon chrome steel, where it is advisable to preheat at 600 F 1200 F , and 1550 1600 F before entering the high heat Never place a cold piece of steel in a high heat furnace
Non-uniform quench	To insure a uniform quench place extra holes in large sections and plug the holes with fireclay or asbestos wherever possible in thin portions The quench may be also retarded on thin sections by the use of an asbestos jacket or by coating with any of the pastes which are available
Grain growth	There is great danger of cracking when steels are overheated due to the resultant grain growth If steels are overheated it is necessary to cool in air to room temperature and then to proceed with the correct hardening treatment
Soft Spots	Scale or gas pockets on the surface will cause soft spots which will have a different cooling action from the surrounding hardening material Actually, the hardened material will shrink away from the soft material causing flaking at the surface
Failure to relieve hardening strains	Place material in tempering furnace immediately after hardening while the piece is still 200-300 F. warm Give a long enough draw so that the structure is completely homogenized Short, rushed draws promote cracking, especially during the grinding operations
Cold deformation	On hobbing steels cracking will generally occur if the annealing operation is omitted prior to hardening

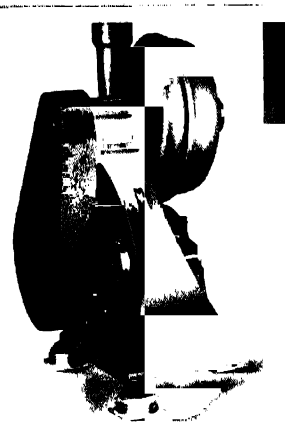
WARPAGE (SHAPE CHANGE)

CAUSE	METHODS OF CORRECTION
Mill scale	Remove sufficient surface material from all sides of the piece to be treated as recommended by the steel manufacturers When mill scale (bar stock) is allowed to remain on one surface, the heating and cooling rates will differ from the others, causing warpage
Design	Avoid the combination of light and heavy sections If a heavy section is required, reduce its mass by drilling a few well placed holes so that the cooling and heating rates of the sections will be somewhat similar
Surface condition	Often the hardener will receive parts that are rough machined on one surface and ground on another, this produces an unbalanced condition in heating and in subsequent cooling, causing warpage It is advisable to have all surfaces finished alike
Gas pockets	Gas liberated from the quench if adhering to portions of the part will cause warpage This warpage can be minimized by correctly agitating the sample or by flush quenching the part, also, on parts with sharp recesses the pieces should be quenched



Nine Billion Revolutions

. . . no Relubrication



WHEN they mounted these New Departure Self-Sealed ball bearings on their blower shaft for testing, the Allen-Billmyre Company of South Norwalk, Conn., were looking for bearings that would give them dependable, long-life operation *minus* the cost and bother of frequent lubrication.

More than 15,000 hours, 24 hours a day, at nearly 10,000 r.p.m., or the equivalent of over 6 years normal operation, with the bearings still going strong, demonstrated beyond doubt that they had found what they wanted in these pioneer Lubricated-for-Life bearings.

Remember: When it's a matter of bearings, New Departure engineers are always "at your service." Nothing rolls like a ball.

"Sealed!" is the title of an intensely interesting booklet describing the development and many uses of the self-sealed bearing pioneered by New Departure. Booklet D-6 free upon request. New Departure, Bristol, Conn.

NEW DEPARTURE

PIONEER OF THE SELF-SEALED BEARING

2925

Heat-Treating Troubles and Their Correction

	so that the gas is not trapped next to the part. If necessary, holes can be drilled to allow the escape of any trapped gas.
Overheating	If work is inadvertently overheated, allow the piece to cool in air to room temperature before proceeding; then reheat to the proper temperature for quenching.
Machining Strains	A stress anneal after the rough machining operation is very beneficial in reducing warpage.

SOFT SPOTS

CAUSE	METHODS OF CORRECTION
Quenching media	Tap water should not be used for quenching unless used under pressure as during a flush quench where the water is continually passing over the surface. Tap water contains a large amount of dissolved gas which is liberated on contact with hot metal thus preventing rapid cooling. The addition of 5 to 10 per cent of salt will reduce the amount of dissolved gases and help to eliminate soft spots.
Bath temperature	When the temperature of the quenching bath is too hot, the cooling rate may be retarded sufficiently so that some steels will have soft spots and very often fail to harden.
Insufficient agitation	Agitation must always be rapid enough to insure the elimination of gas pockets. This may be done by flush quenching or by moving the part rapidly through the media.
Scale	Scale on the surface retards the quenching action and should be minimized by use of the proper atmosphere.
Tongs	If the grasping portion of the tongs covers too great an area that section will cool to below the critical temperature resulting in failure to harden. Have proper tongs available to handle various classes of work.
Dirty compound	Foreign material, such as fireclay and scale, in the carburizing compound will cause soft spots when in contact with the work by inhibiting the carburizing action. Never allow parts to be in contact with one another in the pack as soft spots will result at the point of contact.

SIZE CHANGE (Growth or Shrinkage)*

CAUSE	METHODS OF CORRECTION
Heating	On steels which harden all the way through, overheating above the recommended temperature will cause expansion of the parts and heating below the recommended temperature will cause shrinkage. Be certain of the correct hardening temperature.
Depth of hardness	Steels which are of the surface hardening variety (water hardening) or case-hardening steels tend to shrink on hardening. The higher alloyed steels which harden all the way through, such as oil-hardening and air-hardening types, usually tend to grow. These points should be considered when selecting the steel.
Excessive scaling	With the use of improper furnace atmospheres scaling may become so excessive as to cause size change due to the material lost. Determine the right atmosphere for your job. When an atmosphere furnace is not available, use an oxidizing atmosphere for carbon and oil-hardening steels, and a reducing atmosphere for high-speed and stainless steels.
Quenching	If cooling rates of outer and inner surfaces vary excessively, shrinkage will generally be found to occur. Flush quenching will tend to equalize cooling rates.
Cold-drawn stock	When heated, cold-drawn stock will expand due to the release of the drawing strains. An anneal before machining will correct this.
Nitriding	There is always a definite growth in size during the nitriding operation and this should be allowed for.

SPALLING

CAUSE	METHODS OF CORRECTION
Carbide network	Carbide network in the grain boundaries of carburized steels causes spalling and can be eliminated by quenching from the carburizing box or by reheating above the critical of the core and quenching.
Grinding	Improper use of the grinding wheel can cause minute cracks which in turn tend to spall in service.

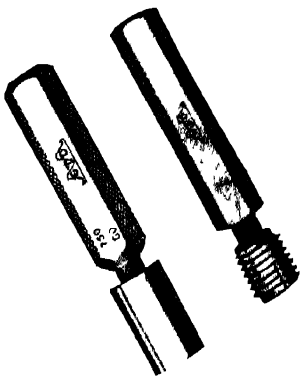
* Size change is often confused with warpage although referring directly to dimensional changes. Warpage implies twisting and bending.

Plenty of gages means faster, more accurate, less expensive production.



Gyro Pilots

CHECKED WITH GTD GREENFIELD GAGES



Gyro pilots are extremely intricate and every part must be manufactured with unusual care and precision.

In this picture of the oil sump assembly can be seen 14 different "GTD Greenfield" Gages — reasons why this part will be *right*.

A long-time record for accurate manufacture, the development of special methods for giving gages long life (such as our "Rex" surface treatment) and our experienced gage engineering service make "GTD Greenfield" Gages especially interesting to any manufacturer who wants to make the most profitable use of his gage investment. A study of your needs will be made without obligation.

The GTD Greenfield" line of gages include plain and threaded, plug and ring gages, plain and thread limit-snap gages, and a large number of special types. All can be furnished with *Greenfield's* exclusive "Rex" Finish for extra long life, if required.

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GTD GREENFIELD

TAPS · DIES · GAGES · TWIST DRILLS · REAMERS · SCREW PLATES · PIPE TOOLS

FULL SPEED AHEAD

UPON ONE POINT the American people agree. The United States should build military and naval establishments so strong that no other power dare attack us The full value of such strength was not realized until France fell so swiftly in June.

That high purpose puts on American industry a huge and grave responsibility. It must literally build a munitions industry from the ground up, and do it in half the time it took either Germany or England.

It sounds like an impossible task, but it can be done, and actually is now on the road to accomplishment. Sooner or later, however, the program will bog down unless the three parties involved cooperate without stint. Those three parties are industry, labor and the government.

None of the three can afford to hold back. Two of the three must not gang up on the other. No one must be diverted from that main task ahead, no matter what the cost.

Industry is doing its part. It has sidetracked its normal business in behalf of the national interest. It has gone ahead, before enabling legislation was enacted by Congress, and invested tens of millions of dollars in new plant facilities and in new equipment.

It has sacrificed all other factors on behalf of speed. To attain speed it often is necessary to employ expensive methods, to utilize whatever is usable and not wait for an ideal set-up. Production becomes costly. Men must be trained. Efficiency of the individual workman drops; his productivity is less. But that is to be expected, and industry does it willingly.

Let's take a look at labor and the government. Labor is getting high rates. Good skilled and semi-skilled men are not easy to find. In many plants men are needed extra hours. It is no time for unions to kick up a fuss. That is, unless an employer has taken unfair advantage of the situation, and it is a reasonable conclusion that few have. They are too busy getting out production and tooling up for new jobs to sit up nights scheming how to do labor out of some of its rights (even if they were thus inclined).

So the latest "informal opinion" of Attorney-General Jackson strikes a rasping note. He said, in effect, that any company which violated the Wagner Act, as interpreted by NLRB and prior to affirmation by the courts, should not be awarded defense contracts.

In view of John L. Lewis' repeated unsuccessful efforts to get Congress to pass a law saying that no violator of the Wagner Act may be eligible for governmennt work, we suspect that Mr. Jackson was attempting to carry the ball which Mr. Lewis previously had fumbled.

And that just doesn't sit well at all. We don't believe the public will like the government's being up to some shenanigans on behalf of a partisan group when it should be directing all its energies toward the main objective—arming the nation. For what the American people want now is results. "Damn the torpedoes; full speed ahead."

Burnham Finney

GAGING BUSINESS

Entire machine tool output for 1941, which should be in excess of $500,000,000, will be required by the defense program. Steel may be ample. U. S. asks aviation industry to work 24-hour day

Machine Tools—There has been no respite in the unprecedented demand for machine tools for the armament program. The situation is aided a bit by the passage of legislation permitting the Federal Government to take over machines now at seaboard which cannot be shipped to foreign buyers because export licenses have been refused. However, that does not relieve the pressure on machine tool builders who, in many cases, have a solid year's backlog on hand. The defense program itself plus British needs will take all their output in 1941, which should be in excess of $500,000,000. While some plants continue to run double shifts on a 50 to 55 hour week, others are on three eight-hour shifts. Priorities on machine tools are being granted aircraft engine builders over ordnance and other Army requirements. Some confusion is resulting, however, from too many defense contracts being given a preferential rating instead of being classified more carefully in relation to delivery time. Britain is continuing to secure large shipments of machine tools, most of the machines going to England rather than to Canada and Australia. Contrary to general impression, some machine tools not essential in the defense program are still going out to Russia. Customers making peacetime products are finding it almost impossible to secure machine tools at this time. For this reason it is a pretty well accepted fact that no new automobile models will be offered for 1942.

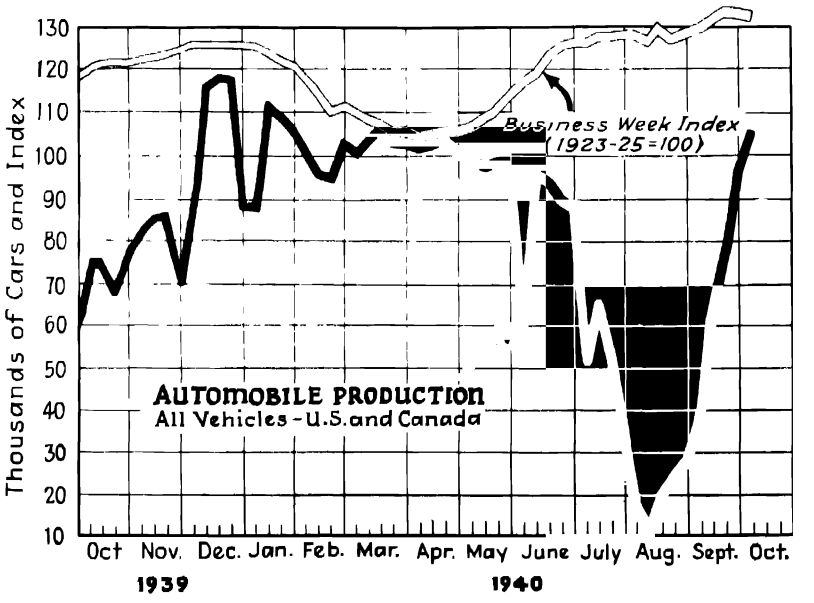
Railway Equipment—About 33,500 freight cars have been ordered this year, or approximately the same number as in the first nine months of 1939. Locomotive bookings are well ahead of those a year ago. Substantial defense contracts plus good equipment business have put manufacturers in a position where they are beginning to worry about deliveries and getting steel. Northern Pacific has ordered 20 locomotives and the Wheeling & Lake Erie some 1,800 freight cars. Baltimore & Ohio will buy 1,000 cars and will build a like number at its Cumberland, Md., shops.

Farm Equipment—Export sales this year, estimated at upward of $87,000,000, will be the best since 1930. One maker reports English business 50 per cent higher this year than last. Domestic volume will approach the peak year of 1937. Tractor manufacturers are enjoying excellent sales because of good industrial demand on top of an active farm market.

Steel—The steel industry will be able to handle the defense load without much expansion of facilities unless all the tonnage is concentrated in a short period, which appears unlikely. Republic, Carnegie-Illinois and Crucible are among companies adding electric furnace making capacity, which will be needed in producing alloy steels. Biggest demand will be for shell steel. A possible shortage of bar mill capacity is reported, though it may be avoided. Some steel men foresee the necessity soon for voluntary if not compulsory priority on steel deliveries.

Aircraft—Rapid plant expansion has temporarily interfered to some extent with airplane production. For that reason output of 950 planes this month is somewhat behind the planned timetable. By January 1 around 1,250 planes a month will be assembled. Splitting up planes into minor assemblies for few designs instead of many and subcontracting certain branches of the work are aiding greatly in getting out higher production. In September about 2,400 engines were turned out. That figure will be surpassed this month. The War Department has asked all plane makers to work 24 hr. a day wherever feasible. Buick and Studebaker are reported negotiating to build 2,000-hp. radial Wright engines under a licensing arrangement similar to that under which Ford is starting to make Pratt & Whitney engines. Each company is said to be counting on 1,000 engines a month. Bendix Aviation, in addition to acquiring an Atwater Kent factory in Philadelphia, has purchased the long-idle Wayne, Mich., body plant of Graham-Paige and will employ 1,500 men on overflow work on defense contracts.

Munitions—Contracts totaling almost $1,200,000,000 have been placed with private industry by the Ordnance Department of the War Department since the defense program started. For ordnance purposes almost 100 plants must be constructed in various parts of the country at an expenditure of over $1,000,000,000. Over 60 per cent of the money made available by Congress for munitions manufacture has been awarded. Arsenals are on a three-shift basis, though they are having trouble securing enough skilled men, including inspectors. Light tank production is at a rate of 100 units a month. No medium-weight tanks will be manufactured by private companies until about May.



Canadians Make Impressive Progress in War Effort; Aircraft, Steel, Gun Plants Speeded

OTTAWA—Though Canada's war effort will not reach a peak for some months, impressive progress has been made This is in face of the fact that the British have been extremely slow in placing volume orders for munitions and aircraft in Canada Not until after the French debacle did things begin to happen rapidly

The Empire Air Training Program is ahead of schedule Airdromes to have been completed in 1941 and 1942 are now almost ready, some 2 000 buildings having been erected The Royal Canadian Air Force today consists of 2 500 officers, 23 000 men and 3 500 civilians Airplane parts and materials heretofore bought outside exclusively, are to be made in Canada

While some semi-official talk is heard about building airplane engines in Canada, government officers are fully aware of the obstacles A shortage of skilled men exists and it would be impossible at this time to get technical men from the United States and England needed in training an engineering and production force Canada also recognizes the great technical difficulties in getting such a complicated mechanism as an airplane engine into production within a reasonable length of time It is believed that it would take 18 to 24 months to set up a plant and have it working properly

Capacity Steel Production

Canada this year will use its full steel-making capacity of 2 300 000 tons Because of the heavy demand it has been necessary to enforce priorities, the highest priority being given to plants making shell and munitions Next in priority rating is steel for building plants for making munitions Steel for non-war uses has been severely restricted

Approximately $10 000,000 has been spent in constructing and equipping aircraft plants Backlogs of plane makers today exceed $100,000 000 In the award of war contracts, as much as possible has been done by competitive bidding

Plants exclusively for munitions manufacture which must be erected to meet the current emergency are permitted short-time depreciation and write-offs for tax purposes A government depreciation board determines the peacetime value of a wartime plant, if any and supervises the rates In arriving at a basis for excess profits, the government takes an average of the earnings of the four years preceding the war In the case of a new company the tax is based on the average earnings in that industry In so-called 'lame duck' or depressed industries the basis is a return of 5-10 per cent on the capital invested instead of recent profits The excess profits tax is a flat 75 per cent If a company has not earned any excess profits it still must pay an additional 12 per cent on top of its 18 per cent corporation tax making a minimum of 30 per cent tax on gross earnings

Guns Ahead of Schedule

Canada started from scratch in the manufacture of guns in this war The Bren machine gun factory (John Inglis Co Toronto) is far ahead of schedule The same is true of a factory making heavy field guns A rifle plant has been built By the latter part of 1941 Canada expects to be independent in gun production, not dependent upon any other country Canada has not been so handicapped in shell manufacture because it took up this time where it left off in the world war

Output of some alloy steels in Canada has been quadrupled since the war began Some $48 000 000 is being expended for increased production of aluminum and $20 000 000 for chemical factories Ground has been broken for a third explosives plant this one to be located in western Canada

DESIGN IDEAS ARE WELCOME

WASHINGTON—Both Army and Navy will welcome any worthwhile ideas on design or process Commissioner Coe of the U S Patent Office indicates that only one in a thousand submitted are worthy of consideration but these are passed along to the Research Division of the Defense Commission However this routine for suggestions is easily sidestepped by engineers and industrialists of standing by direct approach to Army and Navy officers

Plenty of Scrap Iron and Steel In U. S., No Need for Price Rise

WASHINGTON—Committees of steel producers and iron and steel scrap dealers met with the Defense Commission last week Leon Henderson in charge of industrial price stabilization said after the meeting that scrap dealers can maintain the defense supply level without price disturbance Further meetings will be held Orderly buying he said will eliminate withholding and speculation Government will cooperate The Commission is making surveys to determine how new areas of salvage can be made available

This announcement that there is plenty of scrap puts the President's embargo on export to Japan squarely among measures short of war



Wide World

Army Machine Guns—*At the plant of Colt's Patent Fire Arms Mfg Co, Hartford Conn, men are inspecting the 50 calibre machine guns being manufactured for the U S Army Both 50 and 30 calibre guns are produced and the plant is speeding production for national defense*

WRIGHT BUILDS FOUNDRY

NEW YORK—Wright Aeronautical Corp. has established America's first line production foundry devoted exclusively to the molding and casting of aluminum alloy cylinder heads for aircraft engines for national defense. Observers indicate that the establishment of the auxiliary foundry will prevent a bottleneck from developing in the manufacture of cylinders and will be an important factor in increasing Wright's production to meet the requirements of the defense program. The new foundry has facilities providing for all manufacturing operations from raw material to finished product.

G. E. Lighting Conference Studies Industrial Illumination

CLEVELAND—More precise application of lamps to industrial and non-industrial illumination was forecast at the Lighting Conference staged at the General Electric Institute, Nela Park. Officials and engineers of the Lamp Department, General Electric Company, offered two-score business lamp editors a new concept—that lamps are essentially generators of radiant energy. Thus, if the specifications of the seeing task are adequately known, lamps emitting the proper wave length and color can be selected to provide satisfactory optical control, reflection—diffusion properties, color, and size or contour perception.

Flourescent lighting has grown from practically nothing to a $40,000,000 industry in the past 30 months. Papers presented by G. E. engineers discussed various forms of fluorescent lighting in stores, offices, drafting rooms and shop interiors.

High-bay lighting in factories, wherein glare-free illumination of the working plane may reach 50 ft. candles, can be adequately met with combined incandescent and mercury vapor lamps. For illumination of bench or machine, where the light source is nearby, modern fluorescent lighting fixtures provide cool but intense light. Daylight or white light can be selected according to the nature of the seeing task. Light tubes from a 40-watt size 18-in. long to a new 100-watt model 5 ft. long were exhibited.

At the conference it was disclosed that G. E. is now prepared to furnish fluorescent fixtures with controls that suppress the stroboscopic effect that formerly has been distressing to workers viewing moving machinery elements. A new-type fixture has been developed for explosion hazards, such as ammunition loading plants.

Wholesale Standardization of Airplanes Deferred Until 1942; Designers Plan Change

WASHINGTON—A few months ago standardization of airplane types was the panacea that was going to provide lots of planes quickly. Now that the program is drawn up and the contracts let, it turns out that the planners were too optimistic. There has been some reduction in the number of Army types, but in general standardization has been deferred until the big model change in 1942,—when new models will be ordered.

Only in the case of the light attack bombers has Army standardized on a single combat model, a Douglas. The North American advanced trainer and the Vultee basic trainer are now standard, but on all other types at least two models and sometimes more are being bought.

The vital question of standardization as between British and U. S. demand has hardly been touched as yet. An exception is the Curtiss pursuit plane, P-40D, which is identical with the export model. The U. S. Navy and the British are attempting to get together on Consolidated ships, but more typical is the situation at Martin, where parallel assembly lines are turning out one medium bomber for this country and a different one for England.

The basis for this situation is the decision that in a period of major expansion (from a present 10,000.000 sq. ft. to about 25,000,000 ft.) production can only be held at a high level if each manufacturer is working on types he is familiar with. This applies especially to engines and reflects over into airplanes. When two engines of similar output are differently shaped, there must be different airplanes available in which to use them.

In 1942, when the major part of the expansion will have been accomplished and the 35,000-plane program completed, the picture will change. In going over to new models for the next U. S. and British program, it will be possible to do some real standardization. Designers are now working on that basis. If we are at war, this will mean one model in each type. If not, we will probaly retain some competition by using two of each type.

Under the present program, Army is buying two heavy bombers, Consolidated and Boeing. There are two medium bombers, Martin and Douglas. There are four single-engine pursuits: Republic, Bell, Curtiss and North American. Both Lockheed and Grumman are making two-engine pursuits. No attempt at all is being made to standardize trainers.

Export of Machinery During August, 1940

	August 1940	July 1940	August 1939
Electrical Machinery and Apparatus	$9,688,513	$8,890,619	$8,696,318
Power and generating machinery except automotive and electrical	1,462,055	1,522,915	1,560,056
Construction and conveying machinery	2,821,332	2,352,152	2,450,830
Mining, well and pumping machinery	4,144,971	4,746,107	5,013,157
Power-driven, metal-working machinery	21,420,050	14,906,312	9,870,911
Other metal-working machinery	938,087	582,087	439,774
Textile machinery	1,141,173	937,061	753,699

Metal-Working Machinery

Engine lathes	$1,024,332	$727,930	$511,526
Turret lathes	1,326,523	1,019,565	847,477
Other lathes	1,457,000	629,638	451,747
Vertical boring mills and chucking machines	1,333,474	307,944	345,972
Thread cutting and automatic screw machines	1,077,950	523,749	568,977
Knee and column type milling machines	756,859	587,325	378,887
Other milling machines	2,107,320	1,315,960	1,307,131
Gear cutting machines	836,626	484,344	236,851
Vertical drilling machines	369,218	142,756	27,610
Radial drilling machines	230,760	206,836	74,503
Other drilling machines	318,015	494,947	139,089
Planers and shapers	564,407	855,283	338,547
Surfaces grinding machines	713,839	167,122	179,209
External cylindrical grinding machines	579,583	399,539	184,612
Internal grinding machines	924,321	485,327	465,997
Tool grinding, cutter grinding and universal grinding machines	718,869	354,798	436,371
Other metal-grinding machines and parts	1,567,809	909,175	425,013
Sheet and plate metal-working machines and parts	764,546	1,850,366	612,220
Forging machinery and parts	979,220	337,907	359,048
Rolling mill machinery and parts	1,175,648	1,006,770	755,812
Molding machines	39,616	221,124	176,482
Other foundry equipment and parts	165,777	90,159	118,476
Other power-driven metal-working machines and parts	2,083,228	1,976,694	1,103,455
Pneumatic portable tools	117,693	102,356	146,365
Other portable and hand or foot-operated metal-working machines and parts	197,447	147,000	133,609
Chucks for machine tools	56,254	70,448	21,906
Milling cutters, machine-operated threading dies, and taps and similar machine-operated metal cutting tools	197,344	107,030	73,228
Other metal-working machine tools and parts	369,949	155,213	64,066

Over $7,000,000 in Contracts Cleared; Machine Tools Needed

NEW YORK — Contracts totaling $2,153,436,283 for the Army had been cleared by the Defense Commission up to September 28, declared William S. Knudsen at the annual dinner of the Army Ordnance Association, October 8. This amount, distributed among 531 manufacturers, does not include work allotted to the arsenals On top of that volume the Defense Commission has cleared Navy contracts for $5,100,000,000.

Output of planes in October, said Mr. Knudsen, will be 900-950 against a schedule of 1,133. Plans call for production of 1,250 planes a month by January 1 and 1,500 by July 1, stepping up to a goal of 3,000 monthly by the spring of 1942. Aircraft engine output in September was about 2,400 units, of which 1,500 were combat engines and the balance trainers. Tank production is around 100 a month of the 13-ton type. Heavier tanks will begin to come off lines next May. Arsenals are working 24 hr. a day on anti-tank and anti-aircraft guns, and private manufacturers will come in as fast as they can get the tools. Machine guns are all placed. Eleven powder and explosives plants have been located and five more are projected.

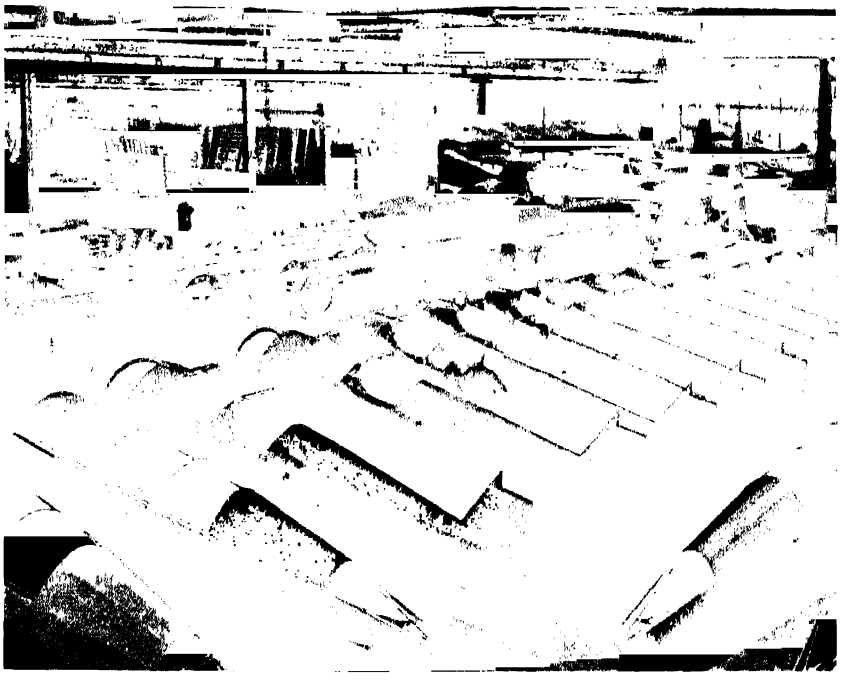
Defense Needs Machine Tools

Mr Knudsen said that defense requirements would take the entire machine tool output the coming year. He stressed the debt industry owes to machine tool builders for developments carried on thru the depression.

Taking exception to Attorney-General Jackson's opinion that companies could not work for the government after NLRB had found them guilty of Wagner Act violations, Mr. Knudsen defined his conception of a sound labor policy. Said he, "I have no objection to collective bargaining or to committees so long as they restrict their activities to their prescribed fields, but I don't want to go beyond this."

America must not expect its procurement program to be delivered within a few months, said Major General James H. Burns, executive to the Assistant Secretary of War. Corresponding programs for the creation of capacity and production of reserves cost both England and Germany some four years of time, and if America can cut this factor in half, she will have done a remarkable job.

Brigadier General R. H. Somers, chief of the technical staff, Ordnance Department, described the types of weapons and projectiles the Army is now using as defense against tanks, saying that "The present trend is toward solid projectiles provided with wind shields to decrease air resistance and with ballistic caps to increase their penetrating ability."



Quick Production—*At the Boeing Airplane Co., Wichita, Kansas, primary training planes for the U. S. Army are being completed at the rate of one every three hours. Within four months the production rate can be further increased to one plane every 90 minutes*

Labor Leaders Faced with a Public Opinion Determined to Arm for Defense; Strategy Fails

NEW YORK—The recent skirmish in the 4-year-old guerrilla warfare between Bethlehem Steel and the C.I.O. highlights labor strategy, 1940 model. For a long time, the organized labor movement has been lobbying and campaigning to get all firms who refuse to enter into contractual relations with unions, barred from government business. With Sidney Hillman as their advocate on the Defense Commission, union officials managed to get a Labor Day statement from the National Defense Advisory Council which underwrote the New Deal labor laws. Subsequently President Roosevelt transmitted this statement to Congress.

When it became apparent that this declaration of policy had not served to usher in a new order of things, the unions sought a device for implementing the declaration. Hillman asked Attorney General Jackson for a ruling on the eligibility of companies, charged by the National Labor Relations Board with indulging in unfair labor practices, to receive federal contracts. Jackson's "informal opinion" giving the unions exactly what they wanted, the consequent storm of protest, and the full dress hearing of the Smith Committee which took testimony from War, Navy and Defense Commission officials and ended up by hearing the Attorney General, not too neatly but effectively, reversing himself—the whole shebang was nothing but a lot of very fancy trimming for C.I.O. *vs* Bethlehem Steel.

The Bethlehem case is typical of situations in which the new unions, after their dramatic and unprecedented successes of 1936-37, stalled. In auto, the open shop citadel of Ford, in rubber Goodyear, in steel National, American Rolling Mills, and Bethlehem, were some of the bastions which did not fall before the trumpetings of the new unionism. In 1938 and 1939 the C.I.O. was occupied in "consolidating" what it had. It did not extend its organizational lines. In the lean months it played close to its vest, fighting to hold what it had. To be sure, there was a curtailed staff of organizers in the field doing their day-to-day jobs of "missionary" work among the unorganized in the mass production industries. But conflicts, showdowns, and tests of strength were avoided.

Now men have gone back to work. Dues payments are flowing into union coffers. There is hay to be made. But the climate has changed. These are not the lush, tolerant days of '36-'37 when public opinion met sit-down strikes, slowdowns, quickies, and picket lines with apathy. The whole industrial boom is based on the determination to arm, and arm fast. Any brake on production evokes the full sanctions of popular disapproval.

LIBRARY

Britain and Canada Make More Commitments For War Plants; Fear Labor Shortage

MONTREAL—Although the British and Canadian governments have already financed the construction of some $225,000,000 of armament and war material plants, further commitments totaling approximately $150,000,000 are planned for new war plants. Present production is measured by an annual output of $1,000,000,000 to $1,500,000,000

Among the new plants, which just a short time ago was decided as not necessary to be built in Canada, is an airplane engine plant. At present, however, the need is considered so great that Britain is sending skilled craftsmen to Canada in order to speed up production Britain will also supply the patents for an English-type engine and it will mark the first time that airplane engines have been produced in this country with the exception of an experimental engine produced by the Canadian Car & Foundry Co

At the moment there are 11 different types of airplanes being made in Canada Avro-Ansons, Bolingbroke, Hampdens, Hurricanes, Lysanders Stranrears, Harvards, Fleet 60 Noisemen, Tiger Moth and Fleet Finch Bolingbroke and Hampden bombers and the Hurricane fighters are being made for the British government All the others will be used in Canada, mostly for training purposes The Hampdens, Bolingbrokes and Hurricanes will be powered with English made engines, the training planes with American engines

Recently Canada has been producing airplanes at the rate of 130 per month of which approximately 110 have been training planes Production is being steadily increased, however, and by March of next year the schedule calls for a production rate of 320 to 360 planes per month Two-thirds of these will be for training purposes

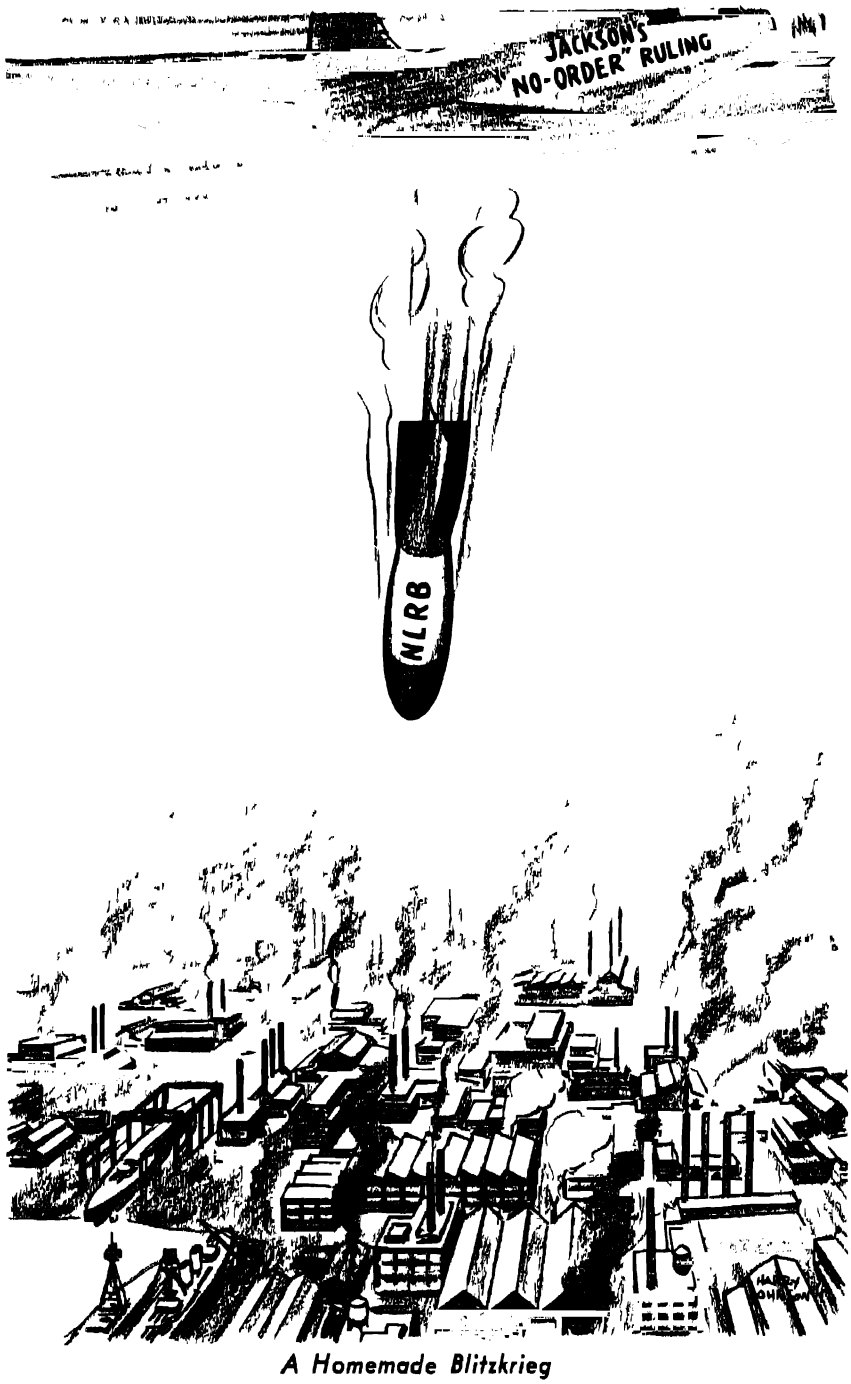
Intense Labor Shortage Seen

The plans for the construction of more war plants will intensify the labor problem On Sept 1, 1940 industrial employment was at an all-time high and only a few of the new government war plants had started production Most of the new plants were scheduled to come into production during the six months following this date All of which indicates to many observers that the shortage of skilled labor is becoming increasingly serious. So important is this problem considered that the government is expected to name a labor administrator with complete authority to divert manpower wherever the need is greatest and the work considered most essential.

Among recent war contracts received was a $2,500,000 order for propeller parts which will be provided by Canadian Car & Foundry Co Other contracts awarded are Aircraft, Canadian Vickers, Ltd, Montreal, $23,708, Noorduyn Aviation, Ltd, Montreal, $94,873, Walter Kidde and Co, Montreal, $10,193 Machinery, Rudel Machinery Co, Ltd, Montreal, $32,276; Williams & Wilson Ltd, Montreal, $38,668, Canadian Fairbanks-Morse, Ltd, Ottawa, $34,149, Boyles Bros Drilling Co, Ltd, Port Arthur, Ont, $48,897 Munitions, MacDonald Mfg Toronto, $13,751 Ordnance, Small Arms Ltd, Toronto, $3,000,000

RECENT DEFENSE ORDERS

WASHINGTON—Huge expenditures for ammunition components characterize recent defense orders which saw $6,040,000 placed with American Car & Foundry Co $4,634,500 with J I Case Co, and $3,365,000 with National Tube Co Orders for airplanes were North American Aviation Inc, $37,770,981, Glenn L Martin, $99,641,880, Douglas Aircraft Co Inc, $178,320 731, and Curtiss-Wright Corp, $3 674 526 American Car & Foundry Co secured an order of $37 687,458 for tanks with spare parts



A Homemade Blitzkrieg

WATCHING WASHINGTON

Despite Hillman's and Jackson's decree to deny contracts to firms against whom NLRB has issued orders, Knudsen's Commission will put defense needs first. 40-hour week begins Oct. 23

By BLAINE STUBBLEFIELD

WASHINGTON—Observers quickly concluded last week that Sidney Hillman and Robert Jackson went out on a limb in an effort to deny defense contracts to firms against whom NLRB has issued orders—and that the two men barely escaped a fall as Army and Navy and Knudsen sawed the limb off.

Sidney Hillman, labor head of the Defense Commission, asked Attorney General Jackson whether companies against whom orders had been issued by the NLRB, were in violation of the law while their appeals were pending in court. Jackson said Yes, and this was instantly interpreted to mean that the Defense Commission would deny public contracts to such companies.

Hillman and Jackson were summarily called to the witness stand of the anti-labor Smith Committee investigating NLRB—along with the Secretary of Navy and Assistant Secretary of War, both of whom, emboldened by the defiant Smith atmosphere, said in effect that production was of first concern to them and the NLRB could take a run for itself. But Army and Navy only *place* orders; the Commission must *okay them first.*

Hillman says he did not consult with members of the Commission before he called for Jackson's opinion. This became apparent when Knudsen replied in a speech that when the courts hold that a firm has violated the law of the land, then, as a matter of policy only, defense contracts should not be given that firm until it changes its practices. "Certainly the Defense Commission has no authority and does not want to undertake the job of enforcing the labor laws," he said.

The President, who is really chairman of the chairman-less Commission, alone can take decisive action. This he will not do, unless and until he is forced to, because his wish to maintain the gains of labor approximately offsets his wish to rush arms production against the dictators.

As for Stettinius and Knudsen, Hillman says he did not consult with them before he called for Jackson's opinion. The Commission long ago drafted a set of principles of awarding defense contracts, approved by the President, which contained a requirement that labor laws be observed by contractors. Neither of these Commissioners is a labor baiter by a long way.

As a general prediction of the outcome, it can be said that the Commission's "principles" regarding labor laws will be enforced with moderation. The middle course is practically mandatory. For after all, among those charged with violating NLRB, are many concerns most vital to defense. Some of them have enormous loans from RFC. It is almost funny to think of shutting them out of defense production. On the other hand, there is the whole power of the New Deal behind the Wagner Law and a pledge to maintain labor's gains.

Furthermore, the Administration cannot, at this pre-election hour, afford to permit any ruction, which would immediately go into the oppositions electioneering mill. A compromise course is good enough. For any real recalcitrant manufacturer could be whipped into line with the threat of the plant conscription law.

As this was written, the Labor Relations Board was preparing, for the Defense Commission, a list of firms whose appeals from NLRB orders are pending in court. It contains upward of 200 names. The Congressional Record carried a list, which NLRB said was inaccurate.

Price Control—A Problem

Government and Industry men both are wondering whether it will be possible to control prices as the emergency program goes on. A study and report by the Brookings Institution points to spots, such as copper, zinc, lead and other basic commodities, which may spread through the whole price structure. Beyond the President's resolution against war millionaires, little price curbing is actually being done, except that the industrial price division of the Defense Commission is circulating among Army and Navy procurement officers, urging them to be careful with timing and distribution of their big orders. Even if the Commission is failing in price control, the Administration can hardly afford to admit it and take measures now; political opponents would grab any such admissions and wave them aloft. If anything is to be done, you may expect strong medicine right after election, whoever wins. Substitution of negotiation for bidding will be almost complete by then. If purchasing agencies want to, they can force "satisfactory" terms under the plant conscription law.

THE ADMINSTRATION BACKS UP

WASHINGTON—The Administration is trying to get out of the hole into which it was thrown by the ruling of Attorney General Jackson. Lubin and Harris of the Labor Department have had several conferences with Hillman and Henderson on ways out of the situation. Jackson's efforts to interpret his ruling more liberally is believed to reflect the Administration's feeling that public reaction has been bad, and will become worse.

New Ordnance Plants Possible

The Navy has $115,000,000 which it could use to build new ordnance plants, and officers are surveying Illinois, Ohio, Pennsylvania, Kentucky, Tennessee, and some other middle-west states as possible locations. They will make their recommendations to Secretary Knox. It may be a month before any information on the decision will be available. Navy officials have said that as many as six plants are needed. The survey does not guarantee that any new plants will be built, however. The available money might be used to expand existing facilities.

40-Hour Week Begins Oct. 23

At midnight October 23, the second work-week reduction under the Labor Standards law steps down from 42 to 40 hours. Administrator Philip Fleming says employers whose regular work week begins before the midnight deadline need pay overtime only on time in excess of 42 hours for that week. The 40-hour minimum will apply to their following work week. The Administration is sternly standing its ground that the wage-hour law will add to efficiency on defense production. But much criticism is aimed at the law in general, and at the two-hour reduction in particular. Purpose of the law was to spread work for benefit of the unemployed. Now, faced with the need for fast production, employers must greatly increase their wage cost in time-and-a-half payments, or employ more men. The skilled men they need are not available—so the work-week cut simply amounts to a wage increase for many metal-working concerns.

2,550 Bombers, 5,250 Pursuit Ships Already Ordered by Army

By Robert Colborn

WASHINGTON — Army announced last week that the last ship in its 19,000-plane program had been placed under contract—about three weeks after the bulk of the money became available and a little over three months after money for the partial 4,000-plane program was appropriated. All were contracted before the tax and amortization bill was signed.

Just what sort of airplanes are under contract has never been officially announced. For the first 4,000 or so units, Army released quantities and types just to convince people they really were ordering planes. But after that War Department shut down on information except dollar totals. However, on the basis of scraps of information, some careful guessing, and a few stabs in the dark it is possible to get a rough idea of what's in the program.

Orders Equally Divided

On this basis, it appears that the orders are about equally divided between combat and training types. And it might well be that in an emergency the nearly 6,000 advanced trainers might have tactical value; back in the early thirties a 600-hp fighter would have been considered pretty hot. It is worth noting that without any allowance for replacements and spares, this program will call for better than 9,000 radial engines in the 1,500 to 2,000-hp bracket, a like number of smaller radials, and about 6,500 liquid-cooled engines of 1,000 hp. or better.

The following material is distinctly not guaranteed. Probably no figure in it is exactly right; possibly there are substantial errors. But it offers as good an approximation of the dimensions of the program as is now available.

Planes Ordered For Air Corps Under 1940-41 Appropriations

850 Heavy 4-engine bombers: 500 Boeing, and 350 Consolidated. 2,550 Medium 2-engine bombers: 1,150 Martin, and 1,400 Douglas. 400 2-engine Attack fighters: 400 Douglas. 600 2-engine Pursuit: 600 Lockheed. 5,250 Single-engine pursuit: 1,750 Curtiss, 1,800 North American, 1,000 Republic, and 700 Bell.

9,650 TOTAL COMBAT.

170 Transport: 50 Curtiss, 20 Beech, and 100 Douglas. 5,700 Advanced trainers: 2,000 Curtiss, 3,000 North American, and 700 Beech. 500 Basic trainers: 500 Vultee. 2,950 Primary trainers: 800 Ryan, 800 Fairchild, and 1,350 Stearman.

9,320 TOTAL NON-COMBAT.

18,970 TOTAL ALL TYPES.

18,640 OFFICIAL TOTAL.

Secretary Perkins Predicts New Employment Record; 4 Million Defense Jobs Available

WASHINGTON—The next year will bring the largest increase in employment this country has even witnessed, predicts Secretary of Labor Perkins on the basis of a report made to her by the Labor Department's Bureau of Labor Statistics.

Jobs for 5,000,000 to 6,000,000 persons are seen as a real possibility and with defense industries alone employing about three to four million workers by the end of 1941. The economic significance, Miss Perkins indicates, is that the payrolls or defense workers will lead to more employment in automobile and furniture factories, in textile mills and clothing factories. Retail stores and service industries will all be stimulated. Although the indirect effect of defense expenditures on employment in non-defense industries is felt only after several months, it should bring about an increase in employment of approximately two million additional workers. Some observers indicate that the increase of consumers purchasing power, the result of increased employment, will go a long way toward reducing labor skirmishes and increasing business income.

During June, July and August the Navy let contracts or undertook force-account work for vessels to cost $1,076,000,000. The Bureau of Labor Statistics estimates that by the end of this year 30,000 people will be at work on vessels contracted for in June, July and August. This number will rise to 100,000 by the late summer of 1941 and will reach a peak of 150,000 in the spring of 1942. This estimate does not yet include employment on contracts let in September or to be let in later months.

Of the 4,540,000 man-years of defense industry labor about half will be needed on construction jobs, in shipyards or in factories engaged in making finished products like airplanes and engines, tanks and shells. Some 2,320,000 man-years of labor will be needed primarily to supply the contractors with materials. This labor will extend back into the mines and forests, into plants making semi-finished products, to the railroads and other carriers, and to all workers.

U. S. Government Contracts Awarded to Metal-Working Firms

Contractor	Gov't Agency	Commodity	Amount
Budd Wheel Co., Detroit, Mich	War	Shells	$309,282
Murray Mfg. Corp., Brooklyn, N. Y	War	Shells	902,000
Auto Specialties Mfg. Co., St. Joseph, Mich	War	Shells	1,653,750
Aetna-Standard Engineering Co., Youngstown, Ohio	War	Gun carriages	1,703,050
Pollak Mfg. Co., Arlington, N. J	War	Fuses	349,760
General Electric Co., Schenectady, N. Y	War	Radio	5,288,562
Federal Telegraph Co., Newark, N. J	War	Radio transmitter	.....
Ryan Aeronautical Co., San Diego, Calif	War	Airplanes	2,074,234
Timken-Detroit Axle Co., Detroit, Mich	War	Adapters	624,030
General Motors Corp., (Chevrolet Div.) Detroit, Mich	War	Trucks	276,876
Boeing Aircraft Co., Seattle, Wash	War	Airplanes	70,449,955
Indian Motorcycle Co., Springfield, Mass	War	Motorcycles	182,540
Harley-Davidson Motor Co., Milwaukee, Wisc.	War	Motorcycles	242,515
Bendix Products Division, Bendix Aviation Corp., South Bend, Ind	Navy		
Vought-Sikorsky Aircraft Div., United Aircraft Corp., Stratford, Conn	Navy		
Reo Motors Inc., Lansing, Mich	War	Trucks	283,800
American Forge Div. of The American Brake Shoe & Foundry Co., Chicago, Ill	War	Forgings	244,110
Pullman-Standard Car Mfg. Co., New York, N. Y	War, Ordnance	Motors	838,150
Kennedy-Van Saun Mfg. & Eng. Corp., Danville, Pa	War, Ordnance	Mortars	638,269
Continental Motors Corp., Muskegon, Mich	War, Ordnance	Engines	1,370,311
International Harvester Co., Inc., Washington, D. C	Navy	Trucks	130,144
Douglas Aircraft Co., Inc., Santa Monica, Calif.	Navy	Airplanes	9,002,384
General Machinery Corp., Hamilton, Ohio	Navy	Lathes	588,598
Stewart Warner Corp., Chicago, Ill	War	Artillery ammunition components	1,381,600
Pullman Standard Car Mfg. Co., Butler, Pa	War		1,134,000
National Supply Co., Ambridge, Pa	War		720,000
Norris Stamping & Mfg. Co., Los Angeles, Calif	War		2,544,000
Electric Auto-Lite Co., Toledo, Ohio	War		780,000
Scoville Mfg. Company, Waterbury, Conn	War		2,358,000
Chase Brass & Copper Co., Waterbury, Conn.	War		806,000
General Motors Corp., Anderson, Ind	War		2,530,000
Pennsylvania Forge Corp., Philadelphia, Pa	War		790,000
General Motors Corp., Dayton, Ohio	War		1,208,199
Independent Lock Co., Fitchburg, Mass	War		965,000
Eastern Rolling Mill Co., Baltimore, Md	War		1,883,000
E. I. duPont de Nemours & Co., Inc., Barksdale, Wis	War	Ammunition components	305,500
Revere Copper and Brass, Inc., Baltimore Div., Baltimore, Md	War	Ammunition components	268,100
American Brass Co., Waterbury, Conn	War	Ammunition components	418,575

INSIDE DETROIT

Despite uncertain outlook for price and supply of materials the auto industry sticks to short-term commitments. Sales of 1941 models show good advance. Record output seen for October

BY RUPERT LE GRAND, DETROIT EDITOR

DETROIT — Despite universal optimism that automobile sales will continue at record pace, the automobile industry is not making long-term commitments for materials Steel makers, for example, have attempted to convince purchasing agents that it would be wise to give definite orders to cover the bulk of the model run, so that the mills can fit automotive requirements into their heavy rolling schedules to the best advantage One of the arguments advanced in support of this proposition is that priorities for national-defense may interfere with deliveries later on, and that with definite orders on the books the steel industry could anticipate priorities for the sake of its best customer

These pleas have met with little response Orders are current only for the steel consumption anticipated within the next 60-90 days Of course, one of the most potent levers toward huge initial commitments—that of price slashes to feed hungry mills – is absent this fall While it is true some flat-rolled business was taken in the summer months for less than stated prices that tonnage was quickly rolled and shipped Since then the orders have been taken at full price without question, and there have been no squawks over raising the price of alloy steels a few dollars per ton

Sales Outlook Is Interesting

Automotive purchasing agents are more interested this season in the outlook for late fall and winter sales of the 1941 series than in the more remote questions of possible priorities, price and available supply of raw materials next spring when the full impact of the defense program will be felt Their present policy of placing orders for normal supplies is dictated by that of top management, as ably expressed by M E Coyle Chevrolet general manager In speaking on production plans for the balance of the year, Mr. Coyle said that Chevrolet will produce at rated capacity of 5000 cars daily until initial demand is satisfied, dealers are well stocked and the continuance of demand can be appraised from short range. With steel covered until the year end, it will be several weeks before new buys are made, thereby indicating what the automobile companies think of production possibilities in the first quarter.

It is anybody s guess what the situation will be next March when purchasing agents must make buys to complete the model run Some of them privately express fears that priorities or shortages of supplies may interfere with production or that prices will be sufficiently higher to force an increase in car prices at that time Yet the national-defense program is unlikely to require more than 10 per cent of the nation's steel capacity in the opinion of leading steel operating men And the steel industry is making such good profits at the present rate of operation that it is unlikely to go counter to public opinion by raising prices except where shortages of alloys dictate such a move

There is another angle that must not be forgotten in appraising the automobile industry s caution about long-term commitments for raw materials Reliable sources report that some managements fear that output may be restricted next spring if the present Administration is re-elected Despite the importance of the auto industry in the national economy it is felt that certain political quarters may attempt to force curtailment of output on the ground that raw materials, labor and plant facilities are required for national defense purposes

Automobile sales during September show large gains over the same month last year Chevrolet disposed of 47,363 cars a gain of 65 per cent Pontiac, 14 633, a gain of 69 6 per cent giving that company the largest September since 1929 Buick 23 957 up 113 6 per cent

ARMOR PLATE ORDERS

DETROIT—In connection with Chrysler's program to build 25-ton tanks for the Army local circles understand that an order to fabricate the main armor-plate structure will be let to a major steel company in two or three weeks The cast turrets are a separate proposition Chrysler would like to fabricate a portion of the order, but its wishes may be over-ruled The plan under contemplation calls for shipment of the complete structure ready for assembly at the government tank arsenal now under construction in Detroit About 14 000 lb of rolled armor plate will be needed for each tank and thicknesses have been under debate Case-hardened automotive steel, similar to SAE 4820 has been tested ballistically and found satisfactory



On the Hump—*Pontiac's final assembly line conveyor has a hump that lifts the chassis to the mezzanine where the front-end sub-assembly is produced. The conveyor hump also provides a much needed passage under the long final assembly line*

Executive War Officer



JAMES H. BURNS

Chief at Watervliet



RICHARD H. SOMERS

Directs Procurement



HARRY K. RUTHERFORD

Commands at Aberdeen



JOHN B. ROSE

These gains are spectacular but they do not represent a true measure of the public's reaction to the 1940 and 1941 models respectively, because announcement of new models occurred several weeks earlier this year. Upon comparing initial selling periods for the two seasons, Buick is found enjoying an acceptance approximately 22 per cent better than last year while Chevrolet is about on a par. Ford products are reported to have had a better pre-show response than last year, but actual figures are lacking. In other words, there seems to be some indecision on the part of the public toward jumping into the new-car market. Used-car sales continue strong, and the gain in inventories is not commensurate with the more active trading since introduction of 1941 models.

Sales Best in Years

Cleanups of outgoing models were universally the best in recent years. A survey of several leading makes disclosed that at announcement time for the respective makes, 1940-model stocks ranged from less than one to two cars per dealer. Experience shows that most of these were demonstrators. A typical case will illustrate how effective cleanups were: Pontiac had 3,073 cars in the hands of its 3,800 dealers at announcement. At the end of the second ten-day selling period, this number had shrunk to 1,000 and by the month-end all 1940 models had been cleaned out.

Current assembly rates of the various manufacturers promise to push October output to a new record of 475,000 for the month. But contrary to experience in 1938 and 1939, the assembly rate will reach a peak in October instead of December for the fourth-quarter period. Estimates have placed November at 450,000, December at 400,000 plus. Sales quotas established by leading makers are based upon retail disposal of two-thirds of the cars manufactured in the last quarter.

Whereas introduction of the Champion tripled Studebaker output, Nash is counting upon the Ambassador 600 to account for only one-third of the 12,500 cars scheduled for October. Lowering the prices on the medium-priced sixes and eights and improving the dealer margin on those two lines is expected to place production emphasis on the larger six for the time being.

Aircraft Activities Expand

Stinson Aircraft Corp., now a division of Vultee, will soon return its commercial aviation business to the Wayne, Mich., plant and expects to employ 1000 persons. A year ago the commercial business and a newly developed line of military ships were transferred to a new plant at Nashville, Tenn.

Growth in importance of both military and commercial phases of the business dictates re-opening the Wayne plant and segregation of the two activities. The Tennessee plant will in the future be known as the Nashville Division of Vultee, and the Wayne plant will become the Stinson Division.

Stout Skycraft Corp. is making rapid progress in determining production methods for the stainless-steel training ship developed by W. B. Stout and may be ready to go into production shortly after the first of the year.

Tucker Aircraft Corp., which has been developing confidential engines for the Army (originally company officials mentioned aviation and tank engines before the lid was clamped on) reports that development work may be completed by next March.

Rutherford, Lewis, Rose, Somers, Campbell and Burns Named Generals

WASHINGTON—Harry K. Rutherford, Burton O. Lewis, John B. Rose, Richard H. Somers, and Levin H. Campbell have been appointed Brigadier Generals of the United States Army, and James H. Burns has been named Major General.

Major Gen. Burns will continue his duties as the executive officer, office of the Assistant Secretary of War, and Brigadier Gen. Campbell will continue in charge of plant facilities for Industrial Service of the Ordnance Department. General Somers will continue as commander of the government arsenal at Watervliet, N. Y., and General Rutherford will continue as director of the Procurement Planning Branch in the office of the Assistant Secretary of War General Lewis will continue in charge of production for Industrial Service of the Ordnance Department, and General Rose will continue to command the Aberdeen Proving Ground.

WILL SEIZE MACHINE TOOLS

WASHINGTON—Machine tools held for export but kept in this country by inability to obtain an export license can now be seized by the President and put to national defense work. As the bill granting this power finally passed, it permits tools so seized to be re-sold, so that they are available for use in private plants as well as in government arsenals. The power was particularly needed to meet the not infrequent case in which title has already passed to a foreign owner, who is unwilling to sell.

Eastern Division of Air Associates Moves Into New Plant at Bendix, N. J.

BENDIX, N J—Air Associates, Inc, started production in its new $500 000 plant on Oct 1 after machinery, office furniture and all company equipment had been moved overnight from the old plant at Roosevelt Field, Long Island, N Y Transfer of the company's activities to its new plant were marked by dedication ceremonies at which Gov Harry Moore and other New Jersey state officials participated

Organized in 1927 by Haven B Page, primarily as a distributor of airplanes, aviation parts and equipment, Air Associates in the intervening years has changed its character from that of a supply house to a manufacturing operation Today manufactured products represent the major portion of the company s business Among the products made are many special-order precision accessories for the aviation industry, such as de-icer equipment instruments radio equipment fittings engine and airplane replacement parts hydraulic pumps and control equipment

Erected in a little more than two months by the Austin Company the new plant has a one-story manufacturing area covering 63 000 sq ft with floor space about evenly divided between stock room and machine hop At one side of the machine shop are heat-treating plating, burning grinding departments and a completely equipped testing laboratory The two-story building at the front of the plant which houses the executive sales engineering and general office staffs provides 6 000 sq ft on each floor This plant doubles the company s capacity in the east

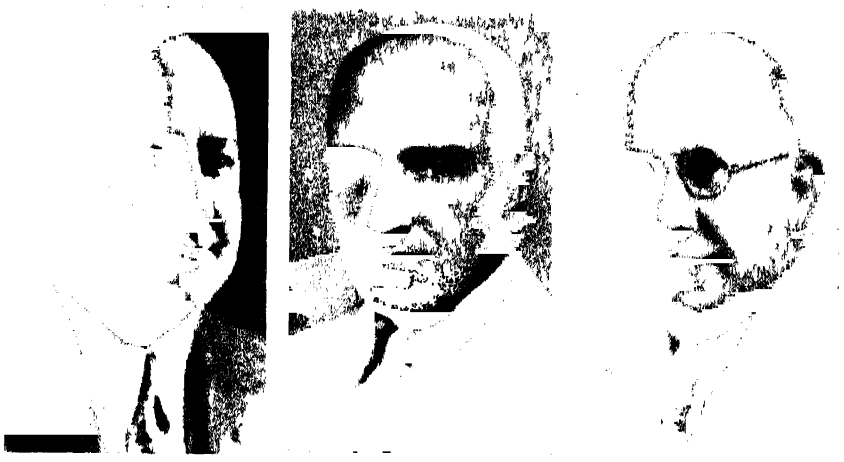
NAMES in the NEWS

H J Barton and C A Peck have been appointed to the Tool Steel Div of Allegheny-Ludlum Steel Corp Pittsburgh, Pa, and Irving H Jones has been named manager of railroad sales Mr Barton has been associated with steel activities on the Pacific Coast for many years while Mr Peck had been in the tool steel business for himself for the past several years prior to his association with Allegheny Ludlum Steel Corp Mr Jones was formerly manager of railroad sales for the Central Alloy Steel Corp, Massillon, Ohio

C Milton Ekberg and William A Russell have been appointed field engineers of Norton Co, Worcester Mass

Thomas E Bragg has been elected a director of the Greenfield (Mass) Tap & Die Corp Greenfield, Mass

Assists Manager *Research Metallurgist* *New Manager*



ROGER H CLAPP T T WATSON W. C WESLOW

Formerly Mr Bragg was associated with Donald G Millar, chairman of the board of directors of the American International Corp

Robert E Brannan has been appointed manager of molding material sales of Bakelite Corp New York N Y Mr Brannan has been a member of the organization since 1923

Roger H Clapp formerly Philadelphia branch manager has been named assistant general manager of sales of John A Roebling s Sons Co Trenton N J Mr Clapp has been an associate since 1936

Archibald Cunningham has been appointed supervisor in charge of tool manufacturing at Curtis Wright Airplane Corp St Louis Mo Mr Cunningham was formerly superintendent of Emsco Derrick & Equipment Co Houston Texas

E George Hartmann has been appointed manager of sales of John A Roebling s Sons Co Trenton N J

Arthur Mackmann former works manager, was elected vice president in charge of manufacturing of Foote Bros Gear & Machine Corp Chicago Ill Mr Mackmann became associated with the corporation in 1928

George W Malcomson has been named assistant sales manager of the Truck Division, Dodge Bros Corp Mr Malcomson joined the Dodge truck sales organization in the special equipment division in 1930 L M Oltman has been named special truck representative of the factory truck sales force in Detroit

Henry R Merrill has been appointed assistant sales manager of the Behr-Manning Corp, Troy, N Y Mr Merrill who had been divisional sales manager of the central division at Cleveland has been in the employ of the company since 1930 Gordon G Thompson, who began his career with Behr-Manning in the sales department, will succeed Mr Merrill as divisional sales manager

Arnold L Nacke has been appointed sales agent in New York City for Modern Tool Works Rochester N Y

Henry J McKenzie executive vice president and general manager of Sterling Pump Corp Hamilton Ohio has been appointed president of the organization to succeed Maurice Rothschild who will continue as a director Mr MacKenzie who will also retain his duties of general manager has been identified with the pump industry since 1917

John L Schmeller has been named vice president in charge of sales of the National Bronze & Aluminum Foundry Co, Cleveland, Ohio

J T Sutliff has been made in charge of the Chicago office of Roots-Connersville Blower Corp, Connersville, Ind

T T Watson former development metallurgist has been appointed research metallurgist in charge of all plant research of Lukens Steel Co, Coatesville, Pa

W C Weslow has been named manager of the mining division of Carboloy Co Inc For the past nine years Mr Weslow has been field and development engineer

M C Wilt has been appointed vice president and general manager of Curtis Lighting Inc Chicago, Ill G T Morrow has been named vice president in charge of sales, H J Dillon vice president in charge of production and L N West, secretary-treasurer

PLANT EXPANSION

The Westinghouse Steam Division Works, Lester, Pa., a division of Westinghouse Electric & Mfg. Co. will expand its present facilities at a cost of over $9,500,000. The move was made to assure on-time delivery of turbines for 45 fighting ships of the U. S. Navy. Over $5,000,000 worth of machine tools and other manufacturing equipment are being installed.

Grumman Aircraft Engineering Corp., Bethpage, L. I., has just started construction of a new $2,100,000 blackout factory. The project, involving nearly half a million square feet of floor space and designed for the manufacture of fighting naval aircraft on a mass production basis, is scheduled for completion in four months.

Marlin-Rockwell Corp., Jamestown, N. Y., has begun construction of a one-story addition to its plant. This will provide 37,000 additional square feet of production floor space.

Producto Machine Co., Bridgeport, Conn., is expanding its plant in order to step up operations for the production of machine tools.

Bell Aircraft Corp., Buffalo, N. Y., will begin construction of a $1,000,000 plant at Niagara Falls. The new plant will be used for the assembly of pursuit planes and will have an area of 240,000 sq.ft. and employ 3,000 workers.

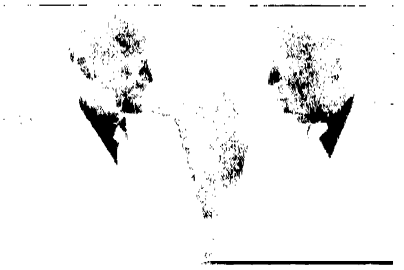
Peerless Machine Co., Racine, Wis., has expanded its manufacturing facilities in order to increase the production of metal cutting saws. Additional space for engineering research and experimental work has also been provided.

Marathon Electric Mfg. Co., Wausau, Wis., is erecting a new plant at a cost of between $150,000 and $175,000. The new plant is scheduled to be completed about January 1.

BUSINESS ITEMS

The Detroit Office of the Geometric Tool Co., New Haven, Conn., will handle the sale of Geometric threading tools and machines in Ohio. The Mill Supply Department of the National Supply Co., of Toledo, former agents of Geometric Tool Co., has been discontinued.

West Coast Industries, Ltd., has been organized at Vancouver, B. C., and will undertake the distribution of important munition orders in British Columbia. The West Coast



Congratulations—*A. E. Alverson, (right) secretary, Greenlee Bros. & Co., Rockford, Ill., is being congratulated for 40 years of continuous service by George C. Purdy, president. Almost 100 officials, superintendents and foremen attended the dinner given in his honor*

Industries, Ltd., is a non-profit organization and its officers and directors are all serving without remuneration.

Powell Machine Works, Inc., Vancouver, B. C., was recently incorporated. The firm's capitalization is composed of 1,000 shares without nominal or par value.

Myron I. Arms, Youngstown, Ohio, has purchased the assets of the Franklin Engine & Mfg. Co., Franklin, Pa. The plant, formerly known as the Franklin Valveless Engine Co., has been named the Arms-Franklin Corp.

Howard Acheson of Acheson Corp., New York, N. Y., has acquired control of Acheson Colloids Corp., Port Huron, Mich. Mr. Acheson has served as president and director of Acheson Colloids since 1929.

Ralph W. Atkinson has been appointed California representative and the Weldon Engineering Co. has been appointed Chicago representative of the Tomkins-Johnson Co., Jackson, Mich.

Sterling Pump Corp., Hamilton, Ohio, has acquired the Turbine Pump Division of the Roots-Connersville Blower Corp., of Connersville, Ind.

OBITUARIES

Carter DeFriest, executive assistant to the Philadelphia Works manager of the General Electric Co., died recently.

Thomas M. Barnes, wire goods manufacturer, died recently at the age of 74. Mr. Barnes was the founder and president of Thomas M. Barnes Co., which began business in 1885.

George Switzer, 40, internationally known industrial designer, died last week after an operation. Since he established his business in 1929, he had designed everything from letterheads and sausage labels to modernistic packages and hearing devices. Mr. Switzer had done work for Westinghouse, E. R. Squibb, International Business Machines, Studebaker, and the Sonotone Corp. At the time of his death he was working on the applications of plastics to the motorcar, railroad and airplane industries. He was a former art director of Erwin Wasey & Co., advertising agency in Chicago.

Freeland O. Stanley, 91, co-inventor of the Stanley steamer automobile, died recently at his home in Newton, Mass. A native of Kingfield, Maine, Stanley and his brother, Frank, first manufactured their steamers in 1897 and production continued until 1923 when the brothers had retired. Their automobile was the first car to travel a mile in less than 2 minutes.

MEETINGS

American Management Association. Annual conference. Cleveland Hotel, Cleveland, Ohio, Nov. 12 and 13.

American Society for Metals. Annual convention. Hotel Statler, Cleveland, Ohio. Oct. 21–25.

American Society of Mechanical Engineers. Annual convention. New York, N. Y., Dec. 2–5.

American Society of Tool Engineers. Semi-annual convention. Cincinnati, Ohio. Oct. 17–19.

American Welding Society. Annual convention. Hotel Cleveland, Cleveland, Ohio. Oct. 20–25.

Associated Machine Tool Dealers of America. Annual convention. Dayton, Ohio, Oct. 21 and 22.

National Exposition of Power and Mechanical Engineering. Grand Central Palace, New York, N. Y. Dec 2–5.

National Metal Exposition, Cleveland, Ohio. Cleveland Public Auditorium. Oct. 21–25.

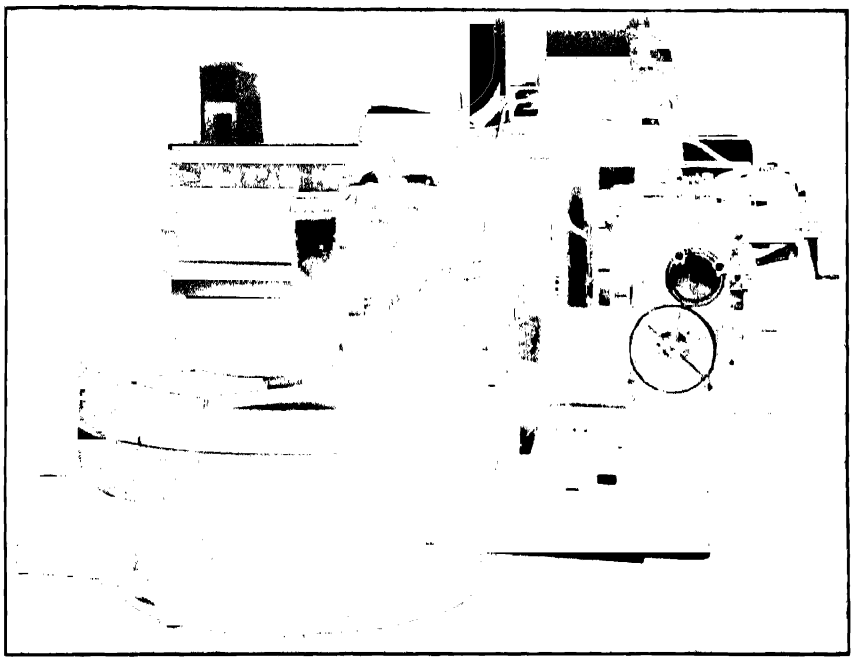
Society of Automotive Engineers. National Aircraft Production Meeting. Hotel Biltmore, Los Angeles, Calif. Oct. 31–Nov. 2.

Society of Automotive Engineers. National Fuels and Lubricants meeting. Hotel Mayo, Tulsa, Okla. Nov. 7–8.

The Wire Association. Annual convention. Carter Hotel, Cleveland, Ohio. Oct. 17–23.

SHOP EQUIPMENT NEWS

Hanchett "Rotary Plano" Surface Grinder Mounts Horizontal or Vertical Spindle

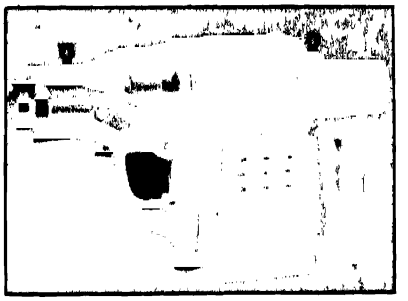


Provision for either a horizontal or vertical spindle is one of the features of the "Rotary Plano" surface grinder offered by Hanchett Mfg Co, Big Rapids, Mich. The horizontal spindle will accommodate a straight wheel, while the vertical spindle can be fitted with either a cylindrical or segmental wheel In any combination the wheelhead can be fed automatically or by hand in increments of from 0 0002 to 0 0030 in

Grinding wheel, driven by a 30-hp, 1,200-r p.m motor, is mounted on a cross rail between two columns This rugged counter-weighted rail has power elevation provided by a 5-hp motor and is automatically clamped to both main and auxiliary columns Grinding wheelhead has adjustable cross feed with a range of speeds of from 3 to 9 in per min, driven by a four-speed ¾-hp motor Ways on which the wheelhead travels are tiltable to 5 deg in either direction

The 72 or 84-in table is driven by a 15-hp motor through a variable-speed unit, which gives a range of table speeds from 6 to 18 r p m It swings work up to 90 in in diam

Machine illustrated has a 24-in diameter wheel with a 5-in face and is grinding a 76x36-in die plate held on a magnetic chuck Weight of this machine with a 72-in magnetic chuck is approximately 75,000 lb

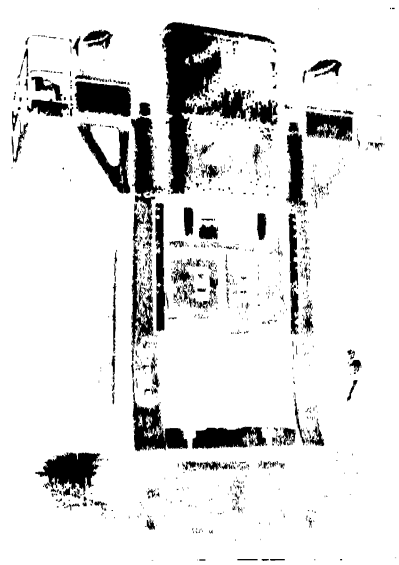


High-Production Speed Lathe Permits Continuous Operation

Considerable time can be saved and heavy bench lathes freed for other work with the high-production speed lathe built by Schauer machine Co, 2060–8 Reading Road, Cincinnati, Ohio Suitable for such light finishing operations as burnishing, lapping, burring and polishing, this machine has been especially designed to permit continuous high-speed operation Collet and spindle are magnetically controlled and are engaged or disengaged by operation of a pedal Special built-in features are available to handle rods tubes or stock

Bliss 800–200-Ton "Hydro-Dynamic" Press Built for Economical High-Speed Operation

The 800–200-ton "Hydro-Dynamic" press made by the Hydraulic Div of E W Bliss Co, 53rd St & Second Ave, Brooklyn, N Y, has been designed especially to incorporate a simple cycle, smooth operation at high speed, and economy of operation and maintenance Press is of the double-action type with universal electric control, and is equipped with an auxiliary hydraulic pressure cushion in the bed



Two 125-hp motors operate the press at high speed Pushbutton control is such that the inner main slide cannot contact the work until after the desired blankholder pressure is applied by the outer slide The main drive brings the two slides simultaneously to the work, the inner slide halting for a fraction of a second, while the blankholder pressure is applied, and then proceeding at the draw speed. Reversal may be controlled either by slide position or by pressure in the system Positive inching for die setting is by pushbutton with the quick advance eliminated, permitting increments of approach of 1/16 in. or less

Press features close-fitting gibs, normally open prefill valve and holding valve. Eliminating cavitation and allowing the machine to purge itself freely of air secures fast generation of pressure and assists materially in achieving high speed Equipment is self-contained throughout, and is

complete with air filter, oil filter, oil strainers, circulating oil cooler and indicating oil temperature gage.

Specifications: main slide capacity, 800 tons; blankholder slide capacity, 200 tons; bed cushion capacity, 150 tons; bed area, 84x85 in.; maximum slide stroke, 42 in.; over-all height, 340 in.

Improved "Millmaster" Miller Provides Increased Capacity

Several improvements have been made in the recently announced "Millmaster" vertical milling machine built by Midway Machine Co., 2324 University Ave., St. Paul, Minn. De luxe models now include center or third pulley attachment and table power feed attachment as standard equipment, table length has been increased from 26 to 38 in., and weight from 1,600 to 1,800 lb

Table power feed unit furnishes power feed to table on longitudinal travel only. A ¼-hp, three-phase motor provides 7 feeds, forward and reverse. All standard models are now furnished with a motor-driven pump and storage tank for coolant. An indexing headstock and tailstock has been made available for all



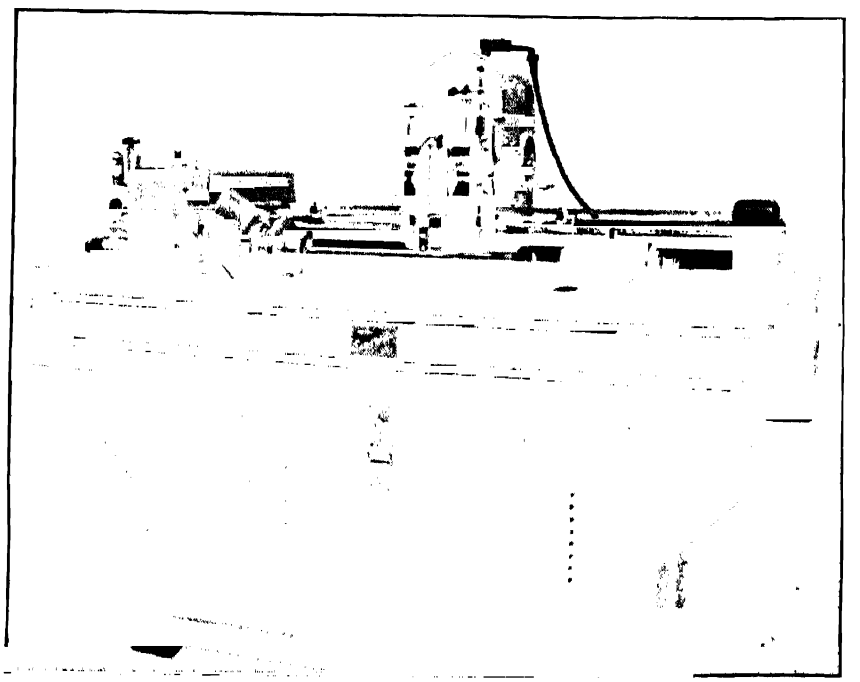
models, and vernier attachments for greater precision are now also available for all models. Also obtainable are special end mill holders for heavy-duty milling. These are optional in place of collets, as standard equipment, or available as accessory equipment

Foster 4x36-in. Superfinishing Machine Designed for Handling Large Cylinders

The 4x36-in Superfinisher developed by Foster Machine Co., Elkhart, Ind., has been designed for work larger than can be accommodated on the general purposes Superfinisher previously announced It is claimed to be ideal for the larger sizes of guide bars for die sets, piloted boring bars, and almost any cylindrical work up to 4 in. in diameter and 36 in in length. The machine can also be built to accommodate work approximately 50 in. between centers.

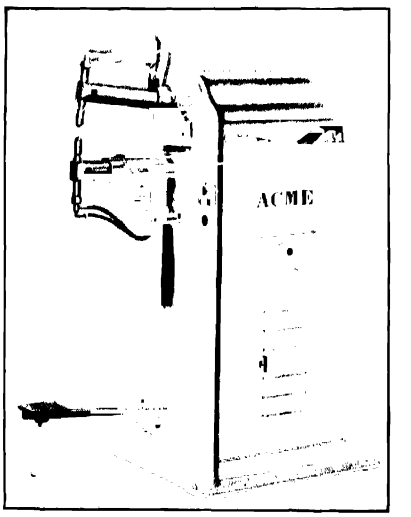
Like the general purpose unit, the 4x36-in. model is designed for collet, chuck, or center work, and may be provided with centerless or flat surface attachments Thus the machine is practically universal in application. Among the special features incorporated in the design is a mechanical drive to the traverse, which also has a hand adjustment for positioning. Spindle is driven by a Graham transmission with a stepless range of speeds 0 to 500 r.p.m. Spindle speed control is in a position convenient for the operator. Machine has a quick stone retraction device. Standard single and double stone holders are available.

Bars carrying the Superfinishing head are horizontally parallel, thus reducing over-all height of the machine. A positive stop for the head may be used to accurately position head in relation to surface when the traverse is not used



"Hot Spot" Welders Made In Capacities up to 50 Kva.

As companion lines to the recently announced Types O and I foot-operated "Hot Spot" welders, Acme Electric Welder Co., Huntington Park, Calif, has developed the foot-operated rocker arm Type 2 in 20 and 30 kva capacities and Type 3 in 40 and 50 kva. capacities.



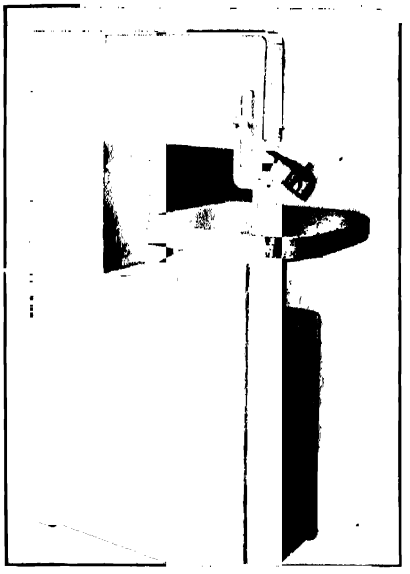
Housings of these welders are of all-welded steel. Horns are double end reversible, one end machined to hold electrodes at 90-deg. angle and opposite end at 22½-deg. angle. Arrangement of the swivel lower horn holder on a long column allows for horizontal and vertical movement of the lower horn to facilitate welding in hard-to-get-at places and deep pans or boxes

Grob Filing Machine Made in Three Sizes

Throat sizes of 18, 30, and 36 in. are available in the improved heavy-duty continuous filing machine made by Grob Bros., Grafton, Wis. This machine consists of a one-piece

welded steel frame, inclosing a ½-hp. motor and V-belt drive in the base. Speeds of 80, 120 and 160 ft. per min. are provided. Tiltable semi-steel table measures 20x20 in.

Files are attached to a chain which is driven by the lower pulley, which has spring-cushioned pins providing a positive drive to the file chain.



Thus little tension is required, insuring long life and accurate file alignment. As the file chain is extremely flexible, two small pulleys can be used in the upper arm as idlers. This permits a low total height with a large throat. Special built-in channels make insertion of new file chains easy.

Carbide Tool Grinding Fixture Accommodates All Tipped Types

Noyes Tool Sales, 601 Laurel Ave., Bridgeport, Conn., has developed a carbide tool grinding fixture which reduces operations to a minimum and covers practically all standard shapes and angles of carbide-tipped tools.

Two plates sliding at right angles to each other are provided, the upper slide having a double angle seat for the tool to provide for right and left tip clearance. This slide also carries a bracket for guiding the tool face across the flat side of the wheel, or at a slight angle to it. The lower slide, which moves lengthwise of the machine, grinds the end face of the tool on the wheel periphery. A guide bracket fastened to the upper slide, adjustable between stops, provides for regulation between the side face and end face of the tool tips. Grinding is controlled by hand pressure.

In operation the side face of the tool can be ground upon the flat or beveled flat of the wheel side, then the slide moved back and the tool passed by the periphery of the wheel

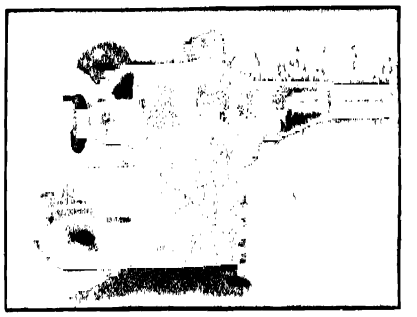


to grind the end tip. The tool is then slipped from its bracket and laid on its side on the other angle of the top plate to grind the top face of the tip.

A roughing and a finishing wheel may be used, one at each end of the grinder, and two combination slide plates provided, the tool being passed from one to the other. An alternative is a combination plate which can be lifted from its bed and dropped at the other wheel. If a chip breaker is required a diamond impregnated wheel is recommended, with the face and side meeting in a 1/16-in. radius. With this wheel at one end of the grinder for finishing, all operations may be roughed out on one end, and the most satisfactory finish obtained at the other.

Aircraft Generator Tester Provides Variable Speeds

A test stand providing an infinite number of speeds has been developed by U. S. Electrical Motors, Inc., 80 34th St., Brooklyn, N. Y., for testing aircraft generators, vacuum pumps,



hydraulic pumps, alternators and other accessories.

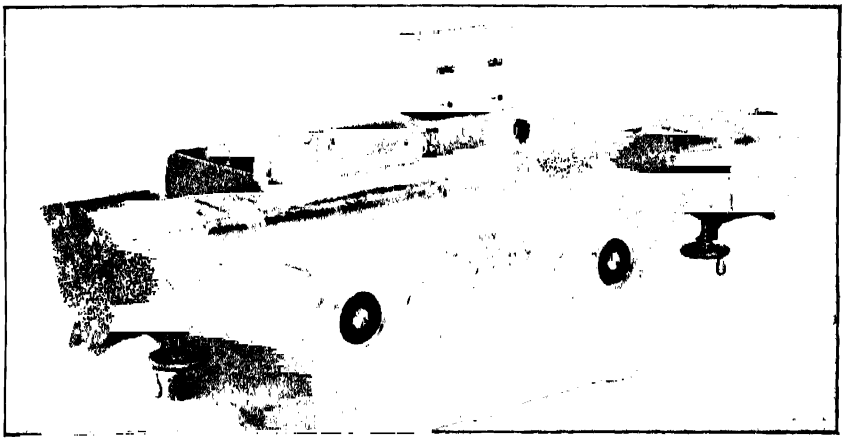
The device to be tested is rigidly aligned by locking it in place on the mounting bracket. This operation is quickly and easily accomplished Positive speed changing is provided by a handwheel which changes takeoff shaft speed in accordance with testing requirements. A positively driven magneto generator and calibrated speed indicator accurately reveal test shaft speed.

Rome Polishing, Buffing and Grinding Lathe Features Independently Driven Wheel Spindles

Covering a wheel spindle speed range of from 1,800 to 7,000 r.p.m., the Model 2AS polishing, buffing and grinding lathe designed by Rome Machinery Sales & Engineering Co., 627-35 Webster St., Rome, N. Y., is equipped with wheel spindles independently driven through 3-hp. motors.

Each speed adjusting handwheel, conveniently operated from each wheel position, is combined with an automatic speed indicating dial. Arranged with 24-in. height from floor to spindle centers to permit operators to work on top of the wheels, this machine is adapted to the hand processing by grinding, polishing and buffing of a wide variety of products, such as cutlery, jewelry, hardware and miscellaneous small metal parts.

Drive mechanism is effectively inclosed and is accessible for servicing through a detachable door at the top of the motor compartment. Spindles run in special heavy-duty ball bearings which are assembled in dust-tight housings. Wheel guards are fabricated from heavy gage steel and are adjustable to compensate for

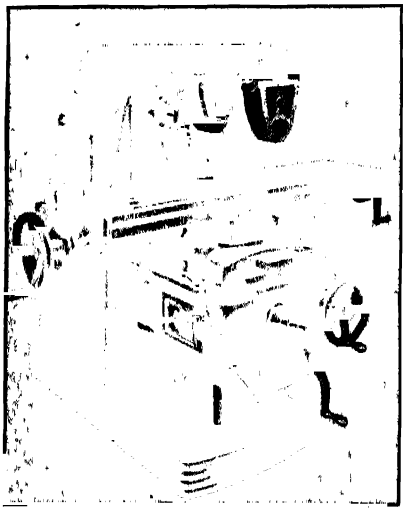


wheel wear. They may be pivoted around the wheel center to any convenient operating position. Weight of the unit, complete with motors and motor starters, is 2,400 lb.

Van Norman Miller Is Plain or Universal

A companion to the recently announced No. 2-L milling machine is the No. 2-S horizontal miller built by Van Norman Machine Tool Co., 160 Wilbraham Ave., Springfield, Mass. This miller is available in both plain and universal types.

Built and powered for maximum metal-removing capacity, it has 18 spindle speeds ranging from 25 to

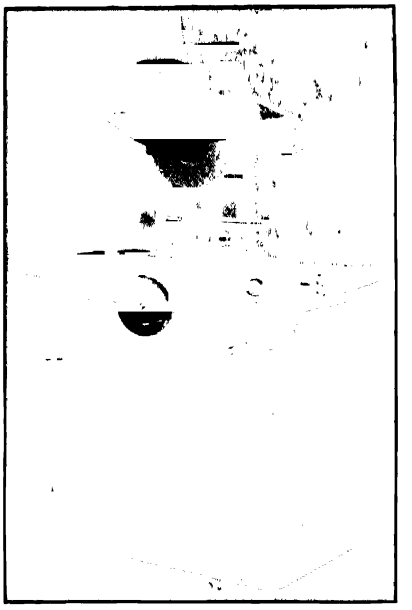


1,250 r.p.m., which are selected by a single lever, as are the 18 feeds which have directional control at both the front and rear. Power rapid traverse in all directions is provided. Machine is equipped with a 5x12-in. table.

Geometric Chaser Grinder Sharpens Chasers Only

To meet the demand for smooth, accurate threads in tough materials, Geometric Tool Co., New Haven, Conn., has developed the No. 20 chaser grinding machine which is built for the single purpose of accurately and economically resharpening die head and tap chasers.

Machine work table is mounted directly on a plane ground surface, and may be manually fed both longitudinally and transversely. A rapid feed is provided, while fine adjustments are possible by means of a micrometer handwheel. Spindle housing is pivotally mounted on a saddle equipped with three ground ways. This saddle may be adjusted vertically by an elevating handwheel, and after adjustment has been made the saddle can be securely locked in position. Final vertical adjustment of the grinding wheel is made by a small micrometer handwheel.



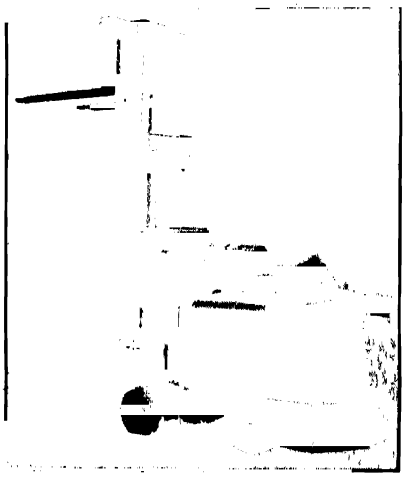
Spindle itself is equipped with a tapered bronze bearing at the front and a radial ball bearing at the rear Adjustment for wear can be easily made.

Specifications: table travel, 8 in. longitudinal, 3¾ in. transverse; table working surface, 4x19 in.; distance from spindle center to table top, 13¼ in. maximum, 2½ in. minimum; motor, 1/3 hp.; floor space required, 44x32 in.; net weight complete with motor, 560 lb

Elwell-Parker Fork Truck Lifts to Three Levels

Elwell-Parker Electric Co., 4205 St. Clair Ave., Cleveland, Ohio, has brought out a Type ERS-3T fork truck capable of elevating loads on skids or pallets to three levels instead of one.

Elevating mechanism is built in three telescoping sections. When uprights are completely lowered, the forks just clear the floor. At the operator's will, forks can be raised to 50½ in. on the first lift, to 88½ in. on the second, and to 112 in. on the third. Rate of upward travel is 20



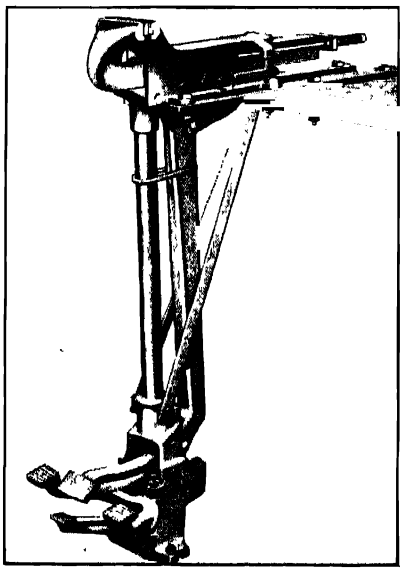
ft. per min., with a 1,500-lb load. With telescoping members lowered, overall height of the truck is but 74 in.

Main driving motor is 4-pole, series wound, capable of sustaining a 500 per cent overload. It is direct-connected to a free-coasting worm and gear, driving the two wheels nearest load, assuring ample traction. Power source can be either acid or alkaline storage batteries. No fuses are needed. When lowering load, regenerated power is returned to the battery. Hoist is operated by a separate motor controlled by pushbutton. It may be tilted 15 deg. backward or 5 deg. forward.

Hoist is provided with ratchet device which operates when the descending load meets an obstruction. A slip clutch serves the same purpose when ascending loads are obstructed. A solenoid brake locks the hoist load in any position. Fork arms are supplied in a variety of dimensions to suit application.

Automatic Vise and Clamp Leaves Both Hands Free

Both hands are left free for work with the automatic vise and clamping tool offered by Automatic Vise Sales Co., 2845 Sunset Place, Los Angeles, Calif. Free-sliding movable jaw is easily pushed with hand or



body against the work, and is then clamped and released with pedals. The main clamping pedal gives sufficient pressure for general work, while if additional pressure is desired an auxiliary pedal gives enough to hold practically any work. Releasing is accomplished by either of two side pedals. All pedals operate with little effort. A simple adjustment permits the device to be set for repetitive work.

All vital parts are made of case-hardened steel. Two types of mounting are available—directly on the

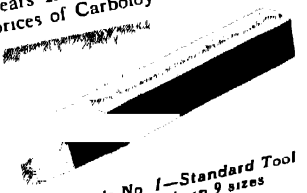
Announced Sept. 3rd—Thousands [illegible] the Metal Industry rapidly [illegible]

NEW...CARBOLOY STANDARD TOOLS FOR "UNIVERSAL" SHOP USE ON 80% OF ALL TURNING, BORING, FACING JOBS!

Detroit, Sept 3 —Mass production on a standardized line of Carboloy tools, designed to cover 80 per cent of all applications for cemented carbide tools, was announced by Carboloy Company, Inc , today

The introduction of this simplified line of tools—comprising but five styles in three different grades—together with the economies resulting from mass production, has made it possible to price these complete tools well below comparable tools in the past, a typical new 'standard' tool, Style 4, now priced at only $1 85, comparing with tools previously cost ing $5 84 in lots of one In quantities of 50 or more this typical tool now costs only $ 90

The program that has made this unprecedented step possible has been under development for the past three years In the period from 1929 to 1937 prices of Carboloy cemented carbide



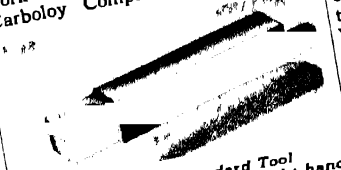
Style No 1—Standard Tool Available in 9 sizes

were progressively reduced four times as the result of economies resulting from increased consumption About that time it became apparent that to widen the scope of useability of Carboloy tools required a complete revision of the principles under which such tools had been produced and sold up to then What was needed was mass production of complete carbide tools on a scale never before attempted in this country

Since 1937 extensive research work in the laboratory and in the field has been devoted to determining the fewest number of 'grades' of Carboloy and the simplest line of tools that would meet the vast majority of all carbide tool applications

New $1,000,000 Plant Part of Program

Early in 1938 this development work had progressed to a point where Carboloy Company could proceed



Style No 4—Standard Tool Available in 9 sizes left and right hand

with its next step—the expenditure of a million dollars on a new plant and equipment to expand and concentrate manufacturing activities This plant, completed in the spring of 1939, was designed with a production capacity of ten times the amount of cemented carbide then consumed by industry, with provisions for expanding metal production to many times that amount

Since that time, research and field experimental work has resulted in reducing the number of grades of Carboloy required for the vast majority of applications to only three —one new grade for steel cutting, and two for cast iron Further, it was found that five styles of tools in each of these grades would cover 80 to 90 per cent of all turning, boring and facing applications

The basic design of these tools is



Style No 13—Standard Tool Available in 5 sizes left and right hand

such that several hundred variations can be rapidly ground in the tools by the user to meet special requirements With the fast, simple grinding procedure developed during the past five years and now widely used by industry, such tool changes can be rapidly and economically accomplished This rapid grinding procedure, plus the fact that the price of these new standard tools is comparable to that of many ordinary tools, brings to the field of Carboloy tool use a flexibility that permits broad 'universal' use of these tools within the average shop on short job lot work as well as production runs

The new standardized tools are carried in stock, ready for shipment, completely ground and ready for use An extremely valuable feature is the incorporation of a ground-in chip breaker on all standard tools designed for the machining of steel, at no additional charge

The new program, according to the announcement, is anticipated to produce a wider scale use of carbide tools, thereby reducing the cost of production of basic cemented carbides to [illegible] that in spite of higher [illegible]

Carboloy Announces 6th Price [illegible]

Since the year when Carboloy tools were first introduced it has been [illegible] Carboloy Co[illegible]

For a number [illegible] have realized the [illegible] reducing the [illegible] lev[illegible]

- ✓ LOW PRICED! (Check against any other cutting tools)
- ✓ SIMPLIFIED ORDERING!
- ✓ SIMPLIFIED TOOL STOCKS!
- ✓ IMMEDIATE SHIPMENT!
- ✓ YOU GET THEM ALL GROUND READY FOR USE! (Steel cutting tools furnished with ground-in chip breaker)

Example of chip breaker ground in steel cutting tools.

[illegible] You the Facts?

WRITE FOR CATALOG GT-125

CARBOLOY COMPANY, INC.

11149 E 8 MILE ST., DETROIT, MICH

Chicago • Cleveland • Newark • Pittsburgh • Philadelphia • Worcester, Mass • Los Angeles

Canadian Distributor: Canadian General Electric Company, Ltd., Toronto

CARBOLOY [illegible] CARBIDES [illegible] CARBIDES [illegible] CARBIDES

[illegible] Reg. U.S. Pat. Office

bench or away from the bench, using steel strips as anchorage. The latter installation gives greater freedom to work on either side of the tool without bench interference.

Cleveland Tonnage Indicator Reveals Loads on Presses

A tonnage indicator for "Steelweld" bending presses has been developed by the Steelweld Machinery Div. of Cleveland Crane & Engineering Co., Wickliffe, Ohio. This indicator keeps both operator and management informed of the loadings to which the press is subjected. It gives warning when dies are worn, and tells when the press is being over-bottomed.

The indicator has two pointers, the



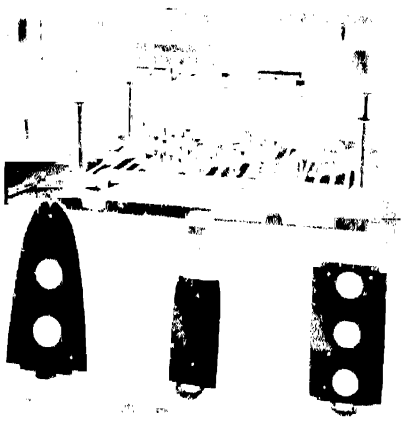
"job" pointer which registers tonnage for the individual job, and the "maximum load" pointer which indicates the maximum load at which the press has ever been operated. The job pointer remains at the highest tonnage reading developed by any of the operations of the job. It may be reset to zero reading at any time. Once set, the indicator requires no further adjustment. A cover that can be locked prevents unauthorized persons from tampering with the device.

Adjustable Die Sets Cut Production Time

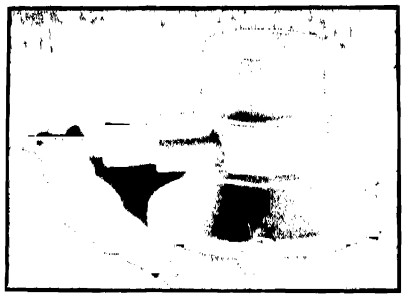
A great aid in reducing time required to get into production and at the same time answering the problem for economical dies for perforating and notching sheet metal is claimed for the universal adjustable die sets offered by S. B. Whistler & Sons, Inc., Buffalo, N. Y. Made in various sizes, these die sets permit much closer grouping of punches and strippers than possible by other methods.

Once in the possession of the user, these adjustable die sets may be rearranged as often as desired. Various sizes of punches for perforating and notching can be arranged in different positions to suit the job in hand. Even a difficult arrangement may be completed and press operations started within a matter of hours. Set-ups can be made by the operator while the die set is right on the press.

Being available in stock sizes from



0 to 1½ in., most punching arrangements can be made up with little loss of time Because of compact design, press operations are reduced to a minimum through close grouping of large number of dies in a given area. In the foreground of the illustration are several airplane parts perforated on these universal adjustable die sets



"Esico" Solder Pots Made for Fast Dipping

A line of "Esico" solder pots developed by Electric Soldering Iron Co., Deep River, Conn., has been especially developed for production jobs where fast dipping of parts is required. Claimed to be highly efficient from a heating standpoint, these pots incorporate a pilot light which indicates when the heating unit is in operation. Should the element or the power supply fail, this light will immediately indicate the fact, making possible prompt correction of the difficulty before production is affected

These units are ruggedly constructed and are not top-heavy They may be screwed to benches where there is a possibility of their being hit or jarred. They are available for use on both 115 and 230 volts, in wattages from 200 to 450 Capacities range from ¼ to 6¼ lb

Hardinge High-Speed Precision Lathe Designed for Simplicity of Operation

Hardinge Brothers, Inc., Elmira, N. Y., has introduced a line of high-speed precision bench lathes which combine rugged construction with simplicity of design. Features include an inclosed head with preloaded ball-bearing spindle, an electrical driving unit with a multi-speed motor which eliminates all gears, clutches and pulleys, and a lever speed control at the headstock

Amply proportioned machine bed rests on three spheres for perfect three-point suspension Headstock bearings are fully inclosed in an inner chamber. Rear of the spindle carries a double pulley for V-belts from the driving unit. These belts may be changed without removing headstock spindle or bearing The compound slide rest has large bevel dials Tailstock spindle retains full



RESULTS COUNT!



"Excellent results for over five years have proved the value of Cities Service Cutting Oils in all of our operations, including threading, tapping and drilling," writes the purchasing director of a large electrical manufacturing company.*

This is but one of many examples where Cities Service Metal Cutting Lubricants have justified the title, "Service Proved."

We will welcome an opportunity to tell you more about them and about our Lubrication Engineers' Service. Just fill out the coupon below and mail it for further information.

Copies of our booklet, "Metal Cutting Lubrication" are still available to users of metal cutting lubricants. Write for your copy today before the supply is exhausted.

*NAME FURNISHED ON REQUEST

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bearing in any position and has a precision ball-bearing to absorb thrust. A metal chart shows which of the eight speeds from 230 to 3,000 r.p.m. is being delivered by the driving unit.

Welded steel pedestal completely incloses motor and driving mechanism to afford greater safety and protection from dirt. Ample cabinet storage space is provided. This lathe is offered in five sizes up to 1-in. collet capacity and 9-in. swing

Hanna Riveting Press Requires Little Floor Space

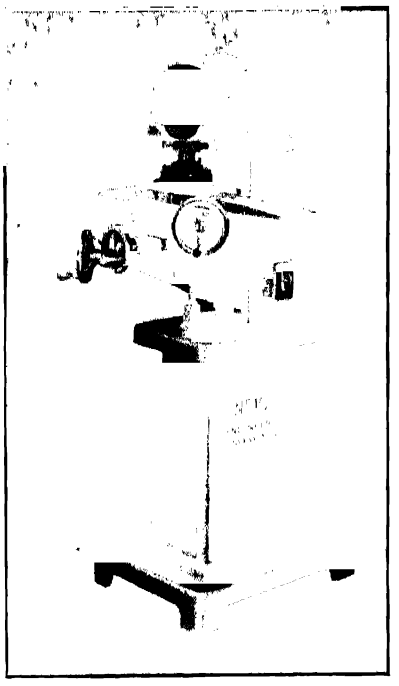
The latest addition to the line of electric-hydraulic riveting presses offered by Hanna Engineering Works, 1765 Elston Ave., Chicago, Ill., has



been designed to occupy a minimum of floor space. In these presses, available in capacities ranging from 10 to 100 tons, motor, pump, controls, piping, cylinder and reservoir are totally inclosed, permitting the motor to be of the open frame type and resulting in an exceptionally clean design. Accessibility is provided through easily removable front, rear and side panels. Entire machine can be lifted out of its base without disturbing any hydraulic, electrical or mechanical elements.

From one to six or more rivets may be driven simultaneously, with equal pressure exerted on each rivet regardless of variations in length, hardness or grip. Omission of one or more rivets will not damage work or machine. Work assembly, loading, aligning, clamping and rivet nesting features may be built into the unit. Work is illuminated by built-in lamps.

Tonnage adjustment and gage are directly before the operator's eyes, as is the oil level sight glass. Driving dies may be either above or below. A complete riveting stroke of all dies can be accomplished in less than two seconds regardless of set-up.



Chip Breaker Grinder Sharpens Carbide Tools

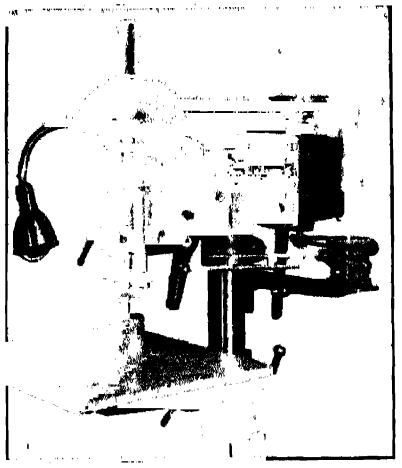
The "Strickland" precision chip breaker grinder developed by Engineering Service, Inc., Box 44, Huntington Park, Calif., has been designed especially for precision diamond wheel grinding of carbide cutting tool chip breakers. When equipped with the "Strickland" universal quick setting ball joint vise, this machine permits grinding all angles of the cutting tool at one set-up.

Both vertical and traverse adjustments of the grinder are precision controlled by graduated handwheels Reciprocating longitudinal movement is controlled by a rocking motion of the handwheel. Machine is provided with a coolant reservoir and regulating valve to maintain constantly the proper degree of moisture on the diamond wheel. Ball-bearing wheel spindle runs at 3,450 r.p.m., providing correct cutting speed for a 6-in. diamond wheel.

Specifications: longitudinal table travel, 12 in.; transverse table travel, 6 in.; vertical movement, 5½ in.; working surface of table, 5x12 in.; motor, ½ hp.; net weight, 450 lb.

"Reciproc" Oscilling Mechanism Improves Drill Press Operation

When used for drum sanding or die grinding, operation of any drill press is claimed to be materially improved with the addition of the "Reciproc" oscillating mechanism developed by Specialty Machinery Co., 5606 Euclid



Ave., Cleveland, Ohio. This device provides the sanding drum with the longitudinal motion necessary to achieve a satin-smooth finish which requires no subsequent handwork The device is claimed to function equally well whether processing wood, plastics or metal.

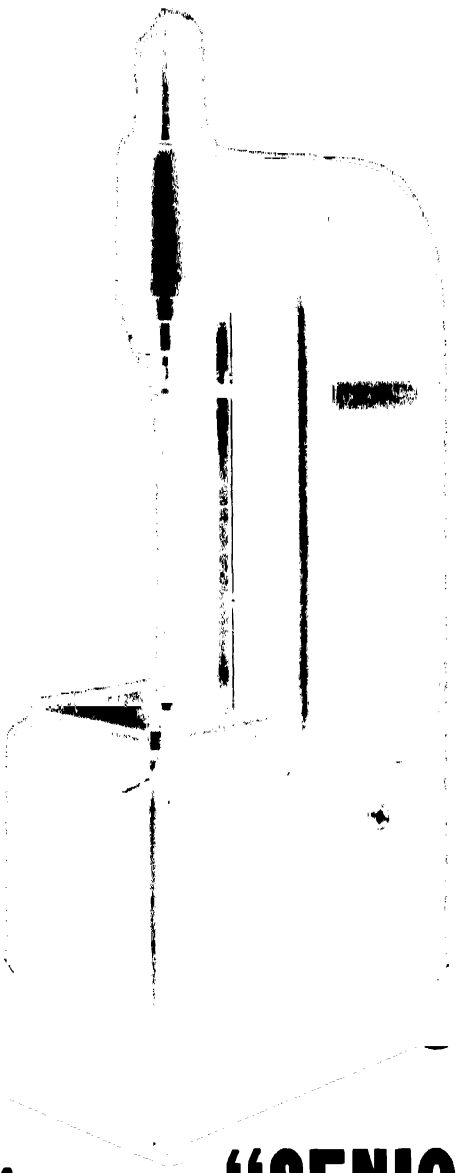
Mechanism fits any standard commercial drill press. It consists of a gear reduction unit mounted on a universally adjustable bracket which in turn bolts onto the drill press motor bracket. A gear reducer is driven by a belt from the lower idle motor shaft. The low-speed shaft of the reducer carries a crank arm to which it attached an adjustable connecting rod. This connecting rod actuates a rocker arm which is clamped on the spindle feed shaft With a 1,740-r.p.m. motor, the device provides the drill press spindle with 100 complete strokes per minute Stroke is adjustable to any length between ¼ and ⅞ in. Mechanism is mounted on a drill press in a few minutes, and once installed need not be removed as it does not interfere with other drill press operations.

Ball-Bearing Sensitive Drill Developed by Langelier Mfg.

Built to precision limits, the No. 41 ball-bearing sensitive drill has been made available by Langelier Mfg. Co., Providence, R. I.

Extra large sealed bearings requiring no additional lubrication are used on the sleeve carrying the driving pulley, and also on the spindle end to take the drill thrust. This spindle mounting eliminates belt pull and thereby makes the feed very sensitive. Feed lever may be adjusted to several different positions with operating rack and pinion protected by a guard.

For drilling to a fixed depth, a coarse setting is made using a stop rod, then the final micrometer adjustment is obtained with a depth stop screw which has a fine thread and is checked in position. Additional features include adjustable motor bracket, table and base with



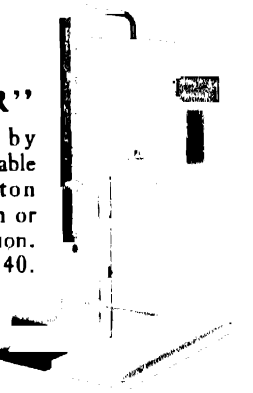
Announcing... "SENIOR" PRESSES

BY COLONIAL

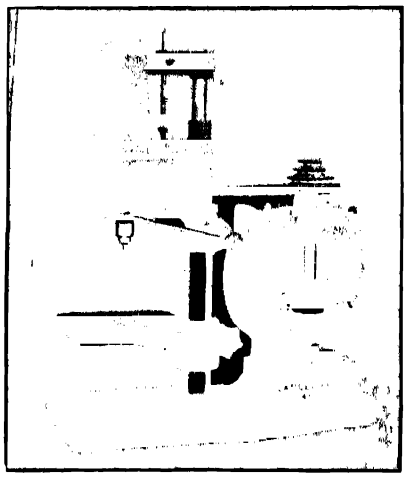
A line of low cost, general purpose hydraulic presses for assembling, broaching, etc. . . . 7 sizes . . . 1 to 10 tons capacity . . . 18 to 42 inch stroke . . . Open side table for working on long parts . . . Minimum floor space with motor mounted in column . . . Large amount of daylight for large fixtures . . . Direct driven high capacity hydraulic pump located within oil tank for maximum efficiency . . . Rugged construction throughout . . . Low priced through standardized design . . . Also available with special hydraulic circuit permitting use of 'shuttling' fixtures . . . *For details send for Bulletin VBS-40.*

"JUNIOR"

. . . Presses by Colonial available in ½ and 1 ton sizes for bench or pedestal operation. Bulletin VJ1-40.



COLONIAL BROACH CO. 147 Jos. Campau DETROIT



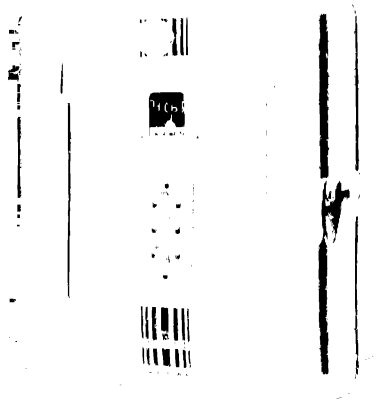
oil-retaining rims, and ball-bearing motor, complete with switch, cord and plug A ¼-in capacity chuck is applied Bench, pedestal and gang models are available

Furnace Pressure Controller Features Extreme Flexibility

Flexibility of installation, convenience of operation and ease of adjustment are stressed in a completely redesigned industrial furnace pressure controller announced by Leeds & Northrup Co, 4934 Stenton Ave, Philadelphia Pa

Mechanism is housed in a rigid, die-cast case Although designed primarily for flush mounting, it can be supplied for surface mounting Controller and related equipment can be panel mounted at the factory and shipped completely connected and wired

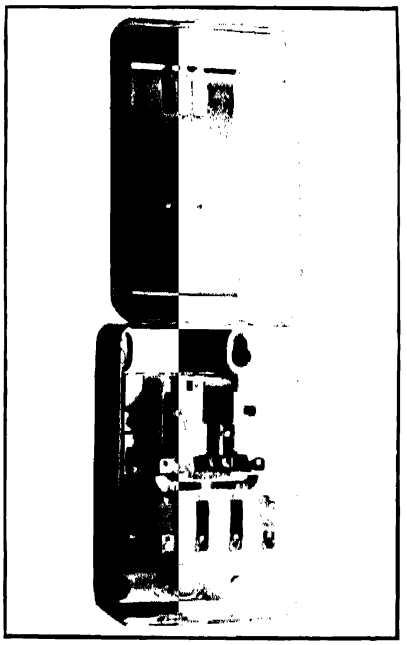
Built into the controller door is a



selector switch and a pushbutton station Integral parts of the instrument, these space-saving accessories enable the operator to take over on manual control at a moment's notice Also located outside the door is a handy control setting knob Through a window, just below it, can be seen a stationary pointer and a movable dial. A turn of the control setting knob rotates the dial and adjusts pressure as required.

Inclosed Type Contactor Handles up to 600 Kva.

Westinghouse Electric & Mfg Co, East Pittsburgh, Pa, has made available as a standard piece of apparatus an inclosed type DN multi-pole contactor This Size 00 contactor is available in ratings up to 10 amp, 600 volts, a c, and may contain as many as eight poles in any combination of normally open and normally



closed contacts required for the most complicated control systems

Inclosure is made of black enamel sheet steel and has a deep drawn snap cover Safety with accessibility to the contacts themselves is thus obtained General shape of the inclosure conforms to that used on the standard line of Westinghouse-manual and magnetic "Line-Starters"

Pipe Cleaning Machine Has Hundred-Yard Range

Oster Mfg Co, Cleveland, Ohio, has developed an electric sewer and pipe cleaning machine claimed to be capable of removing stoppages several hundred feet from the sewer or pipe opening, even when it is necessary to pass through elbows and traps. Revolving different types and stiffnesses of coiled wire "snakes" with various augers and cutting tools attached to them, the device is said to be very efficient in cutting through roots, rags, grease, chips, cinders and many other obstructions

Machine is powered by a ½-hp. universal reversible variable-speed motor driving the spindle, through V-belts A split pulley on the motor can be adjusted to lighten tension on the V-belts, allowing them to slip before the "snakes" become over-



strained in the event that an extra heavy construction is encountered A gripping chuck which revolves the "snakes" eccentrically is mounted on the spindle This eccentric action of the chuck gripping the "snakes" transmits a whip to the tool working in the line, enabling it to do a more thorough job

Case and base of the machine are of fabricated sheet steel Machine is mounted on casters large enough for easy rolling Over-all length is 15 in, width is 15 in, and height is 4 in Net weight is 85 lb

Shop Cleaning Made Easier With Palmer-Shile Cart

A shop clean-up cart that functions like a dust pan on wheels has been announced by Palmer Shile Co, 7100 West Jefferson Ave, Detroit, Mich This cart is said to outmode the wheelbarrow-and-shovel method in cleaning up accumulations of trash,



making an efficient job out of what is normally a puttering one. Mounted on ball bearing rubber-tired wheels, with a capacity of more than a bushel, the cart is easily handled and greatly simplifies the rubbish disposal problem

Industrial Fluorescent Unit Permits Continuous Mounting

A twin lamp open and fluorescent fixture designed especially for general or supplementary continuous strip lighting in low bay industrial areas is offered by Westinghouse Electric & Mfg Co, East Pittsburgh, Pa. These

Type FPC luminaires are available only in two-lamp spread distribution style, utilizing two 40-watt 48-in fluorescent lamps

Units consist of a hood reflector lamp holders, lamp starters and ballast equipment Fabricated sheet steel hood is hinged to reflector to provide easy access for making line connections Reflector is white porcelain-enameled steel giving a high over-all efficiency with cut-off at 72½ deg from vertical

Twin ballast units and compensators provide high power factor minimize cyclic flicker and assure stable lamp performance Luminaires are arranged for rigid or flexible conduit or chain suspension mounting When used in continuous strip lighting special end connecting bushings are furnished These provide rigidity and provision for straight-through wiring Although two supports are required when the fixture is used separately only one support is required for all except the end fixtures when used in strip lighting

"Oxbrite" Cleaning Process Improves Plating Results

The 'Oxbrite method of electro-cleaning brass bronze and other copper alloys before electro-plating has been developed by Oakite Products Inc 22 Thames St New York N Y This process effectively removes foreign matter from work so that bright uniform electro-plated deposits are secured The process also reduces cost by the elimination of the cyanide dip and copper strike before plating In addition it permits soft-soldered work to be bright plated without preliminary copper plating

Another feature claimed for the method is the assurance of freedom from peeling of electro-plated deposits caused by inadequate surface preparation Because it effectively removes all soap films and metallic deposits and also prevents surface embrittlement the method is said to provide much finer adhesion Depending upon the relative amount of buffing compound used and on the shape and other physical characteristics of the particular work two alternate procedures for applying the process are available

NEW MATERIALS

Enamels for Finishing Stoves Offered by Maas & Waldstein

A line of "Codur" enamels especially developed for use on stoves has been made available by Maas & Waldstein Co 438 Riverside Ave Newark N J

These enamels can be supplied in white porcelain white and colors A single coat baked from 5 to 45 min depending upon temperature and type of oven, produces a glossy finish

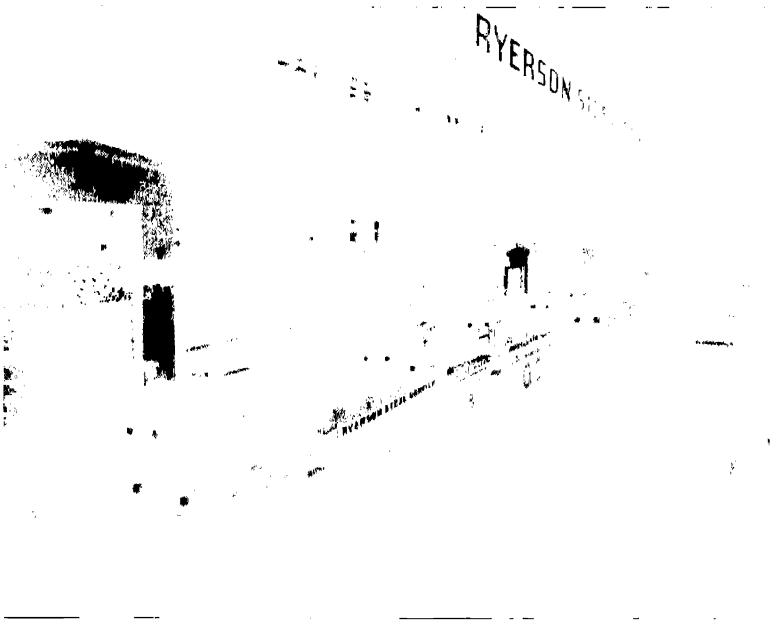
(Advertisement)

Manufacturers Look to Steel Warehouses for Quick Defense Requirements

Many leading manufacturers are relying on nearby steel service plants for prompt stock shipment of steel to meet the current surge of business prompted by Washington's defense program

Probably the leading exponent of Immediate Steel is Ryerson with a network of ten strategically located plants each of which has large and complete stocks of steel and allied products In addition each plant is equipped with complete forming and cutting facilities so steel can be prepared to customer's exact requirements No shop should be without the Ryerson Stock List (see advertisement below)

Thousands of manufacturers report saving considerable time trouble and money by taking advantage of Ryerson's complete flame cutting service Modern equipment manned by specially trained operators can quickly burn any shape no matter how intricate from carbon or alloy steel plates and billets up to 15" thick



Ryerson Night Loading Assures Quicker Deliveries

It's after hours, at any of the ten Ryerson steel plants, almost any night of the year!

The Ryerson night shift is putting the finishing touches on *today's* orders, loading out the fleet of big, red Ryerson trucks for tomorrow's deliveries

Immediate Steel is a Ryerson tradition The entire Ryerson organization is geared up to handle *quickly* the steel requirements, simple or involved, of thousands of customers the country over Special telephone order desks, hourly mail pick ups at the post office, telegraph and teletype lines right into our offices all help to speed delivery, even *before* the order reaches us

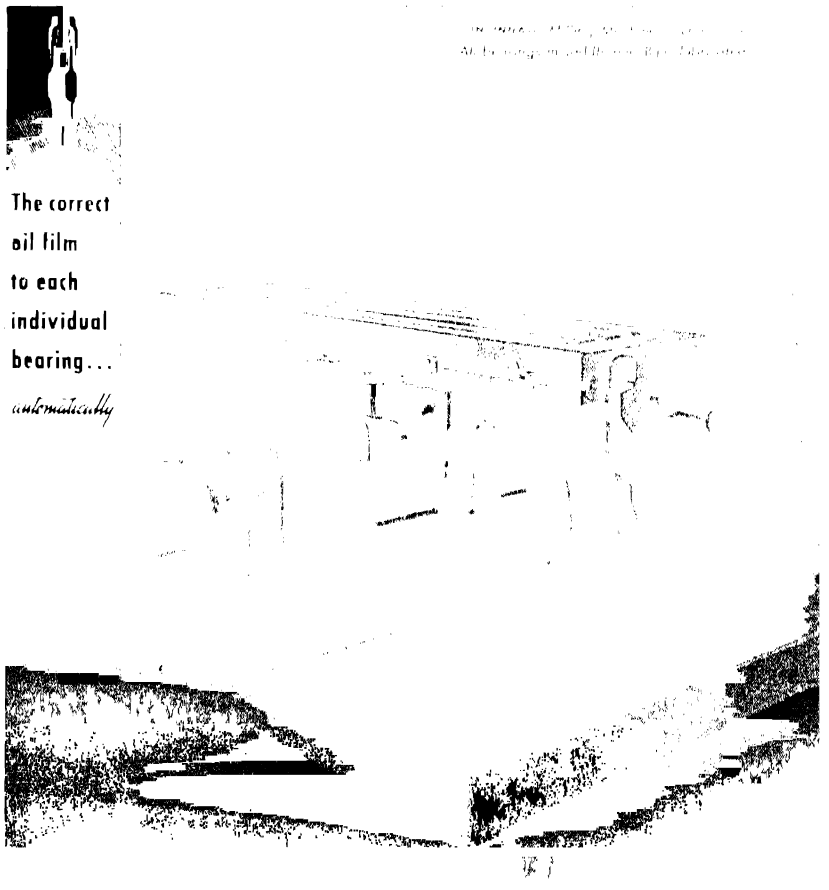
Night loading to "clear the decks" for tomorrow's new crop of orders is the regular course of business Every order is RUSH at Ryerson most are shipped the day received

Ryerson Steel Service is fast and sure, Ryerson Certified quality is your assurance of uniformity and exactness Make the Ryerson Stock List your unfailing source for all steel requirements If you haven't the 1940-41 Stock List we'll send one gladly

Joseph T Ryerson & Son Inc Chicago Milwaukee St Louis Cincinnati Detroit Cleveland Buffalo Boston Philadelphia Jersey City

RYERSON CERTIFIED STEEL

RYERSON



• BIJUR-equipped machines *hold* efficiency . . . maintain accuracy of work . . . permit both higher-quality and higher-speed production. • Positive "metered" lubrication insures smooth running — reduces many items of cost. • Adapted to any machine design . . . Bijur equipment makes your machine a more profitable investment!

BIJUR LUBRICATING CORPORATION • LONG ISLAND CITY, NEW YORK

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AUTOMATICALLY *Correct* LUBRICATION

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NEW MACHINES YOU BUY
ARE AUTOMATICALLY
LUBRICATED

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which is said to be resistant to marring, hot grease and kerosene and which will withstand heating to 420 deg F for eight hours without noticeable discoloration For more severe service, a special high-heat gloss enamel is available which will withstand 425 F for twelve hours without objectionable discoloration

An attractive and durable finish for heaters is achieved with "Duart" wrinkle enamel followed by a coat of "Metalustre" of any desired color This type of finish will withstand 420 F for 150 hours without darkening A single coat of pigmented "Duart" wrinkle enamel can also be used

"Swedish" Iron Powder Made in United States

Metals Refining Co Div of Glidden Co, Hammond, Ind, has begun production of iron powder which is claimed to be the equivalent of "Swedish" iron powder Since the supply of iron powder from Sweden has recently been greatly reduced this American-made product should prove of considerable value to the metalworking industry

"Saty-Nite" Enamel Developed To Protect Hot Water Tanks

To commemorate the traditional bath night, Porcelain Enamel & Mfg Co, Eastern & Pemco Aves, Baltimore Md, has applied the name of "Saty-Nite" to a porcelain finish especially developed for hot water tanks Tests indicate that this enamel triples the usefulness of even the best quality hot water tanks now on the market affording greater protection against corrosion under severe conditions

TRADE PUBLICATIONS

ALLOY STEEL Jessop Steel Co, Washington, Pa, has issued a six-page folder which describes "Truform", a non-shrinkable, oil hardening alloy steel for use in tools and dies where extreme accuracy is required

ARC WELDERS A 144-page bulletin "Lessons in Arc Welding," published by the Lincoln Electric Co, Cleveland, Ohio, contains over 100 illustrations and comprehensive practical information for arc welders

BEARINGS Johnson Bronze Co, New Castle, Pa, is circulating three data sheets which describe the operation and construction of self-lubricating bearings

CADMIUM PLATING A complete manual for operation and maintenance of cadium plating solutions is offered by E I du Pont de Nemours & Co, Wilmington, Del

CAPACITORS General Electric Co., Schenectady, N. Y., is circulating Bulletin No. GEL-619 which describes how capacitors reduce feeder loading and improve low voltage conditions.

CONDENSERS General Electric Co., Bloomfield, N. J., has issued a 56-page booklet which describes condensing units from 5 to 60 hp. for both refrigeration and air conditioning installations.

ENGINES Bulletins Nos. S-500-B38, B-39, circulated by Worthington Pump & Machinery Corp, Harrison, N. J., provides a diagramed description of the construction and operation of diesel and convertible engines.

GRINDERS Gardner Machine Co., Beloit, Wis., has published an eight-page booklet which describes the construction and operation of surface grinders.

LAMPS General Electric Co., Cleveland, Ohio, offers Folder No. Y-0224 which describes the use of Mazda mercury lamps for use in industry.

MIXERS A four-page folder showing the various types and sizes of pneumix air-motored agitators is offered by Eclipse Air Brush Co., Inc, Newark, N. J.

PISTONS Aluminum Co. of America, Pittsburgh, Pa., offers Bulletin No. AD-34 which illustrates and describes the various types of pistons, materials and finishes.

PLASTIC MOLDING Crucible Steel Co. of America, New York, N. Y., has issued an eight-page folder which describes the method of selecting the right steel for plastic molding.

ROTOMILL National Broach & Machine Co., Detroit, Mich., is circulating a 16-page illustrated booklet which describes the application, operation, construction and specifications of Rotomills.

STANDARDS Aircraft Screw Products Co., Inc., Long Island City, N. Y., offers Bulletin No T-1a, which contains engineering standards and technical information on the Aero-Thread screw thread system.

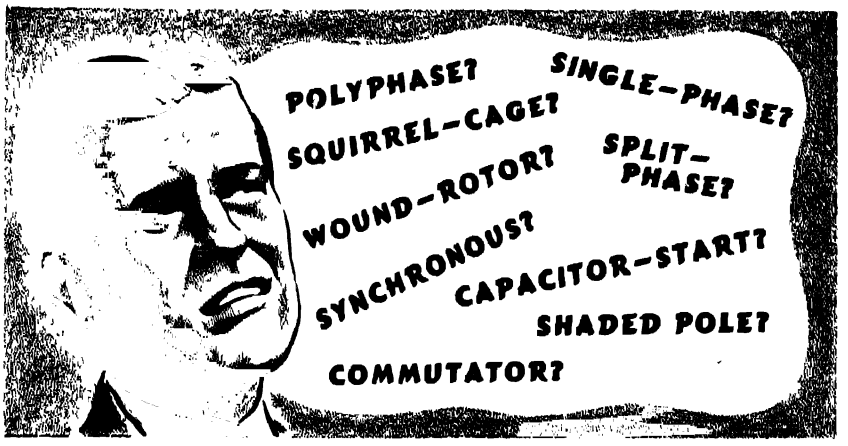
STEEL Joseph T. Ryerson & Son, Inc., Chicago, Ill., offers an eight-page bulletin describing the chemical analyses, working properties, and suggested applications of a wide range of cold finished steel bars.

WATER WHEELS Rodney Hunt Machine Co., Orange, Mass., has published a 124-page catalog, No. WW-40, which covers information on how to modernize water wheels for greater efficiency of operation.

SWITCHGEARS Catalog No. 1230, circulated by Roller-Smith Co., Beth-

WHY BE "IN A FOG

ABOUT A-C MOTOR SELECTION?



LET GraybaR AID YOU IN FITTING MOTORS TO THE JOB

When you put your motor and motor-control problems up to GRAYBAR, you get a double assurance of sure performance: (1) GRAYBAR offers the complete line of *General Electric* motors and controls — backed by G-E research and manufacturing facilities — the line which GRAYBAR experience has proved of greatest value to its customers; (2) GRAYBAR representatives and specialists "on call" are prepared to assist you in choosing the right equipment for the job — service to you is their primary responsibility.

Whether you're selecting motors for plant motive power or types to be "built on" to equipment for resale — it will pay you to put your problem up to GRAYBAR.

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FREE BOOKLET AIDS SELECTION

This free booklet, "How to Select A-C Motors and Control," contains nine factual articles on the special characteristics of different type motors, service factors, capacity ranges, etc. Write GRAYBAR for your copy.

Everything Electrical

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DoALL RELEASES OTHER MACHINE TOOLS ON URGENT DEFENSE JOBS







Chrome Vanadium Steel Part for hydraulic press. Made by Burndy Engineering Co., New York.

Former Milling time ..... 13 hours
The DoAll removed sections shown in 37 minutes, reducing the finish milling to ..... 2 hours

DoAll Savings on Milling...11 hours

The DoAll offers important short cuts in stepping up production. A great time and energy saver in cutting out internal and external shapes from any metal up to 10" thick.

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lehem, Pa., provides an 8-page pictorial description of the construction and operation of air circuit breaker switchgears which are suitable for the control of incoming lines, transformers and distribution facilities.

NEW BOOKS

ENGINEERING MECHANICS—SECOND EDITION—*By S. Timoshenko, professor of theoretical and applied mechanics and D. H. Young, associate professor of civil engineering, Stamford University. 553 pages. McGraw-Hill Book Company, 330 W. 42nd St., New York. $4.00.*

Formerly published as two volumes, this textbook on engineering mechanics has been edited and revised to fit between a single pair of covers. Some of the older sections are rewritten for shorter and simpler approach. Some of the longer and more academic problems have been deleted. In addition, several chapters have been dropped, and their essential contents distributed among other chapters as needed.

As in their original presentation, the authors have planned basic engineering approach to the subject of mechanics. They realize that specific problems are today changing so rapidly that routine use of formulas may prove of little value; instead they strive to establish an understanding of theoretical mechanics and the application of the fundamental principles. This emphasis on the general methods of attack is designed to build a strong foundation, rather than a drill in the use of standardized methods.

SEEN and HEARD

JOHN R. GODFREY

Infra-Red Drying

Ford attracted attention to the possibilities of heating and drying metal parts with incandescent lamps about two years ago. Radiant energy from banks of lamps were used to dry paint on car bodies. Plymouth used portable banks of lamps to furnish 250 F. for drying small areas of paint.

Experimental jobs, having up to 60 reflectors using 260-watt lamps are spotted around the country. (Ford now has about 30,000 reflectors installed in its own plant for complete drying of bodies and other uses). Some of the results show that this type of heating can make material improvement in production where lacquer drying or moisture drying is a problem.

Some successful applications in addition to lacquer drying include: softening of plastic sheets for forming and shearing, baking out armatures and motor coils, pre-heating various materials to improve absorption of varnishes, expanding or sweating one metal object to another, drying surfaces cleaned with water, drying glued joints. Enamel drying has not always been successful, nor was an attempt to dry sheet steel after pickling.

There are still many problems to be solved, but this method of heating offers much in the way of time and space saving, flexibility and portability. Heat is instantaneous at comparatively low cost.

Oil Pockets

Machine tools today are meeting heavier and heavier demands with consequent increased unit pressures on sliding surfaces. Any day in the week you can get an argument out of any two given designers by saying, "It is necessary to improve adjacent sliding surfaces by making them smoother and flatter." Or, if you prefer the other side of the argument you can say, "Milled or planed surfaces will stand up as long as any other provided there is proper mechanical fit, because the low spots serve as retainers for oil."

From then on words will fly thick and fast, and everybody will have a different idea depending on his experience. One of the things that makes wear a difficult subject is that there are so many variables and each industry has its collection of them.

Forgotten Arts

Hacksaws, like second-hand automobiles, are often used but never loved. As a matter of fact, there is a lot to the art which we never suspected until we talked to one of the manufactures of a completely automatic sawing-off machine. It is surprising how much difference there is in the rate of sawing different alloys and how the efficiency of hacksaws can be improved by the proper use of saw blade, cutting pressure and speeds.

Once you get a man interested in the technique of good sawing, you can accomplish a lot of things. One manufacturer is reported to have made savings of $12 to $14 on material by using proper technique with power hack saws. One employee who was given the job of running some automatic saws, became so enamoured with the job that at last reports he was locking every machine when he went out to lunch and when he quit in the evening so that nobody could tamper with them.

Auto Wrecks and Irrigation

Wrecked automobiles, welding outfits and mechanical ingenuity are the stock in trade of at least one small shop on the Florida peninsula. The owner, who is frequently the entire crew as well, has built up quite a business in building irrigation pumps

for growers of various vegetables. Wrecked cars supply the motor which is rebuilt where necessary. They also furnish universal joints for connecting the motor to the pump shaft, sometimes operating at a 30-deg. angle. In such cases two universals are used.

A sheet-steel tube, perhaps 10 or 12 in. in diameter and 15 ft. long, has a shaft centered in it by three equally spaced bolts. On the lower end is a sort of boat propeller made by welding blades direct to the shaft. The propeller end of this large tube is placed below the water level of the irrigation ditch and forces the water up the tube outside the shaft, and out the upper end, which is open. It's no job for any one but an old-time mechanic.

Productability

Too many coined words have "sound appeal" but mean very little. When they express an idea in one or two words they save time and are real additions to the language. One of the things machine users like to know is their ability to produce, in other words their "production ability" as one well known builder put it. It isn't an easy thing to rate, but "productability" seems to cover what we want to know. Productability depends on the material to be machined from the tools used, while in many cases the operator is the most important factor.

Setting standards for the productability of any machine is a man-sized job and depends largely on the kind of work. On roughing work it might be possible to use a "pounds-of-chips-per-hour" basis. On other work it would probably be better to set a comparative standard in pieces per hour on some well known machine and use that as a base. Or it might even be its net earning capacity per hour or hundred hours. By any standard productability is what counts in any machine.

Old Cast Iron Learns New Tricks

While traveling about the country gathering advance information on the late lamented Machine Tool Show we found the phrase "cast iron" covered a multitude of mixtures.

A majority of the cast machine tool bases of today may contain anywhere from 30 per cent up to as much as 80 or 90 per cent steel, often steel rails. Rails are used because of the uniformity of the steel, its cleanliness and fairly narrow range of carbon content. The mixes may include silicon, nickel, chromium, or molybdenum, or combinations of these items, to provide a close grained, high strength iron. The composition depends on the size of section and chilling effects as well as required strength.

In one shaper the bed, saddle, cross slides and table are alternately steel



Today, more than ever the demand is for precision tools that get the results. The CORRECT results — and get them fast! And that's where Lufkin comes in. Years and years of designing new precision tools, improving existing ones and manufacturing only according to the most rigid quality specifications have put into Lufkin products the very things that machinists most need today. It will pay you to look these outstanding tools over. Write for a free copy of catalog 12B.

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mix castings and steel mix plus nickel and chromium castings. Hardness of the two materials differs by about 80 points Brinnel, which is claimed sufficient to prevent galling and permits the effective use of scraped ways integral with the castings.

Lead, Pitch and Multiple Threads

Men whose chief acquaintance with screw threads is confined to bolts and nuts frequently use the terms "pitch" and "lead" interchangeably. But men who handle multiple threads *must* use the terms correctly or get into trouble, as one did recently.

Double and triple threads are not uncommon for rapid traverse of machine parts. But the lens barrels of candid cameras put these to shame in possibilities for error. Some recent examples were 9-15 pitch and 16-40 pitch, which in this case means a fifteen *pitch* thread with nine "starts" and a 40 pitch thread with sixteen "starts." The *leads* were 9/15 or 0.60 in. and 16/40 or 0.40 in. *lead.*

Making and using taps of this kind requires care in planning for chips as well as in relief and in centering in the work. On thin barrels it is advisable to tap the hole before turning the outside on account of the danger of swelling or spreading

Redraw After Grinding

Dies should be redrawn after grinding to about 50 F. less than the original drawing temperature. This practice takes extra time in reconditioning the tool, but proves helpful in obtaining longer life between grinds. The redraw overcomes strains set up in grinding, particularly when the wheel is not maintained in the best condition, or is not exactly suited to the job. Removal of strains by this method does not impair the temper, but does minimize checking of the tool. Besides lengthening the time between grinds, the practice of redrawing the tool may save making another die plate in some instances.

Left-overs and Scrap Parts

Being able to find things in the shop saves a lot of annoyance as well as time and money. The large shop usually buys and keeps a large enough quantity of bolts, washers, cotters, rods and sheet or strip metal to have definite bins or racks where it can be found. But many small shops have only a little more than is needed for the job in hand and all too frequently mislay the left-overs. Then when one or more are needed for another job, the hunt begins. It would frequently be much cheaper to buy new ones than to waste the time in hunting. But this means going to the supply house, which means more

time wasted. The loss comes in waste of time and exasperation more than the actual cost.

For this reason it pays to spend enough time to start, and carry on, some system of bins or other storage facility, so that spare parts can be found. For small parts some find glass containers very satisfactory, as they show at a glance what is inside. Fruit jars with screw tops, either in pint or quart sizes, are often found convenient. Some fasten the cover to the under side of a shelf and screw the jar into it. This suspends the jar with the contents in plain sight. One advantage is that the jar can be removed and replaced with one hand If several shelves are used space must be allowed for the hand under the jar. They can also be held at an angle if the space available makes this more convenient

Whatever form of storage is used the main thing is to put left-over parts away at once so they can be found when wanted. Much time is frequently saved on important jobs if a few bolts or small parts can be found promptly. Metal bins are made which conserve space and keep parts free from dust. All hands must be trained to put "left-overs" where they belong, or this can be assigned to one of the boys as part of his job.

This also applies to small pieces of bar stock, to tubing, to sheet or strip metal and all other materials that are left from any sort of job. It is economy to save them if they are kept where they can be readily found, but it may be cheaper to throw them away than to waste a lot of time hunting for the piece needed. Nearly everyone saves odds and ends in the hope that they will be needed, but scrap piles that have to be pawed over may be a liability instead of an asset.

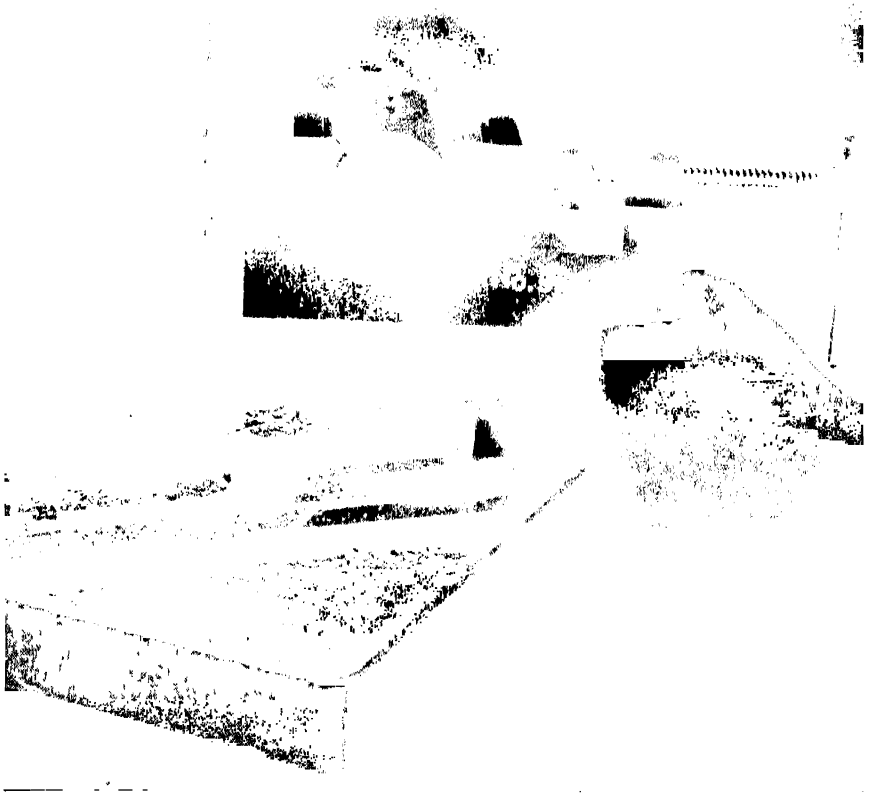
Keeping Machines Clean

By ED WEST

We are always picking up management ideas on how to keep shops clean. Here is a card which one manufacturer blueprints and places on every machine in his shop.

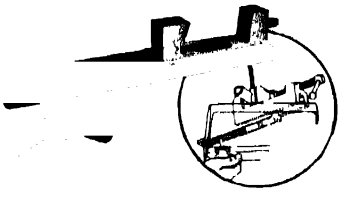
"Operator must report error or defects to the supervisor immediately upon discovery. Scrap due to carelessness will not be tolerated. Read blueprints carefully — check your tools—have the first piece checked by inspector in every instance—do not proceed until inspector has approved first piece. Machines must be kept clean and properly oiled. The use of hammers to set or loosen table or carriage locks on any machine is forbidden. Operators are responsible for the condition of machines on which they work. (We know of another shop which has a slogan tacked to every one of its machines to the effect, "If you are too good to keep this machine cleaned up, you are too good to work here.") Do not abuse

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machinery, jigs or equipment in any manner. Junk or refuse of any kind should not be allowed to accumulate in the vicinity where you are working Avoid the use of air to blow chips off of work or machines, use a brush or wiping cloth Clean the way cleaners of the machines at frequent intervals Check the oil level on your hydraulic machinery before starting work and report drop in level to supervisor immediately Don't lay tools, fixtures, or other pieces on the edges of tote pans, work benches or tool and supply boxes"

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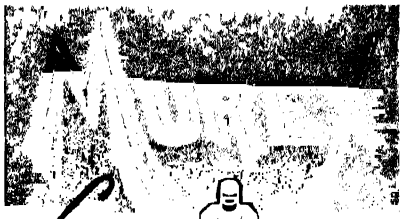
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A Shop Secret

About 30 years ago I visited an auto shop in Reading, Pa, and was shown how they lapped the pistons into the cylinder bores They had copied it from Rolls-Royce, only they had a secret abrasive. A little later a plant in Indianapolis showed me the same operation, with the same abrasive—also a secret I next saw the same thing in a shop overhauling motors for the Speedway racing cars which also included lapping the bearings, with the same abrasive By this time it was no longer a secret; however, it was seldom used

Only recently I visited a builder of machine tools who laps spindles into their bearings and gets a nice job It's a special abrasive—the same as the others But it isn't secret It's hand Sapolio, that has a grit which breaks down and stops cutting after a few minutes At least that's the story that I've been hearing for 30 years—and it does make a nice job

Diamond Tools

The first extensive use of diamond tools which we can remember was in turning the barrels of fountain pens over 30 years ago They had then been employed some time The old Marmon plant in Indianapolis stands out as a pioneer in our recollection We recall diamond boring bars for the main bearings in the crank case The most unusual application at Marmon was a shaper tool with two diamonds for sizing the ends of the bearing caps to secure an accurate fit in the recess in the pillow block That was the only application we ever saw on a reciprocating cut

Public Relations for Presidents

We are thinking about starting a school of public speaking for company officials.

A few months ago we sat in the grandstand listening to the president of a large organization attempt to give a hearty, man-to-man talk to his employees The build-up and introduction were swell, and we all sat back to hear some heartening words from the boss himself. He walked out on the stage, fumbled around in his pockets, finally hauled out two sheets of paper and read his talk to us. Maybe we're wrong, but it seems to us that he would have gotten lots better results if he had just stood up there, rambled on in a friendly way and let the boys know by his smile and his actions and a direct look in the eye that he was really glad to be there and sincerely glad that he was their boss.

Of course, there is the argument that the leaders of a company have more to do than to make friendly speeches to their employees In these days of modern production and manufacturing methods, we're not so sure Maybe companies should adopt the French system of electing as president of the company a man who can make the public appearances and do all the social duties of the job while in back of the scenes is a premier who runs the show

Let George Do It

By B HERMAN

A trait observed among machinists in some shops is the "let George do it" attitude This probably makes for more riled tempers than any other factor Especially is this true in shops where each man is obliged to carry through a job requiring the use of several machines In a group of such men there is usually one patient George Watch him as he goes about his work

He has a lathe job to do First there is the steady-rest some one used before and left standing on the machine He takes this off and puts it in its place, and then begins to clean away the debris remaining on the lathe from several previous jobs He carefully wipes and oils the ways, and shoots some oil where the machine needs it

He finally puts the job in the chuck and takes a face cut, then goes for a couple of drills In getting the drills from the cabinet, George knows without looking that they're dull, and maybe burned blue He sharpens the drills, makes the holes, and must now mount the work between centers But he finds the center points have been scored since he last ground them off, so he regrinds them He now has the work turning between centers takes a cautious cut and, just as he suspected, the tailstock has been carelessly lined up and the lathe is cutting a taper. He trues up the centers and finally gets his lathe work finished. After cleaning the machine spick and span again, he picks up his drills and several other drills and reamers left lying around by others and replaces them in the cabinet

Poor George? No Poor shop

AMERICAN MACHINIST

October 30, 1940



For the Railroad—*Welding and riveting combine for economic production in A C F's new hopper cars*

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THE CARE AND FEEDING OF 75's

The 75-mm. gun, most useful artillery piece, is also one of the greatest consumers of ammunition. Hence the making of 75-mm. shells is one of the vital firsts in America's defense program. It was also first in American Machinist's series of Armament Sections—now appearing in every issue. Here are typical comments about the first of these practical up-to-the-minute handbooks:

> Please arrange to send us six additional copies of "How to Machine 75-mm. Shell" . . . Address the reprints for my personal attention . . .
>
> H. H. Pinney, *President*,
> E. W. Bliss Co.

> . . . We are very much interested in both of these articles (75-mm. shell—Sept. 5 and Tanks—Sept. 18), as we have a Tank order and a shell order in our defense program . . .
>
> F. J. Lamborn, *Vice-President in charge of Mfg.*,
> Chrysler Corp., Dodge Division

> The article, "How to Machine 75-mm. Shell," is excellent, and we should very much like to receive an additional 25 copies if they are available.
>
> Thor M. Olson, *Vice-President*,
> Ex-Cell-O Corp.

> The special article . . . "How to Machine 75-mm. Shell" . . . is a very complete article on the subject . . .
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> We will appreciate it very much if you will send us a reprint on "How to Machine 75-mm. Shell" . . .
>
> L. M. Quan,
> Fayette R. Plumb, Inc.

Demand has been so great that this section is already out of print, but copies are still available of subsequent sections on Tanks, Cartridge Cases, Heat-Treating Munitions and Welding Munitions. If you anticipate armament orders, ask for extra copies *now*. And read each subsequent section as it appears in AMERICAN MACHINIST—always first with the latest metal-working data.

★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★

WHAT'S IN THIS ISSUE

THE OLD GRIND

Now and then even the best precision grinder, equipped with the right wheel running at the proper speed, will act up and turn out plenty of spoiled work. Nine times out of ten improper wheel dressing is to blame, but finding out what's improper about the established technique is usually something else again. So, with industry groaning under the load of production pressure, with high precision, we feel that H. J. Wills' advice on dressing grinding wheels will be more than welcome. Mr. Wills, as you may already know from previously having made his acquaintance in these pages, is an engineer associated with the Carborundum Company. His article, which begins on page 859, is the first in a series of three.

SENSIBLE

We've seen engineering departments go wild over a particular process, using it for outlandish applications at what must have been tremendous cost. The passion for "all-welded" construction sometimes has put welding in the class of fads. So it was with real pleasure that we came across an example where the designers admitted quite frankly that they used welding where it was cheapest, riveting where *it* was cheapest. This is possibly the highest tribute that could be paid to the art of welding--the process has survived the experimental, skeptic, repair, occasional, and fanatic phases—to emerge victorious as an accepted production tool, to be used unhesitatingly where needed, to be forsaken where too expensive. The application we have in mind is not in a consumer product where price is everything, but in heavy equipment where strength and durability count as heavily as cost—railroad freight cars. On page 862 J. W. Sheffer, of American Car & Foundry, explains why, and how, some 100 hopper cars were fabricated by both welding and riveting.

FIRST LINE

Possibly you think of battleships (long accepted as our first line of defense) solely in terms of guns and armor plate; and while we'd never dispute the persuading ability of a sixteen-inch gun, we'd like to focus attention for a moment on the machinery that puts the ships and their armament in the strategic spot at the right time. We refer to propulsion machinery in general and turbine reduction gearing in particular. For those who wonder why it takes years to build a battleship, we recommend "Geared for Defense," on page 874 of the AMERICAN MACHINIST Armament Section. In it A. A. Ross, of General Electric, outlines some of the steps in making these essential ship components.

RED END

Past the red end of the spectrum lies the infra-red, and past page 866 appears the end of the series of articles on infra-red in industry. In case you have the impression infra-red is useful only in paint drying, John Sasso, author of the series, points out many other applications of the process. Even assembly operations come within its province. But let Mr. Sasso, associate editor of *Product Engineering*, tell you the story: "Versatile!" A man of few words. We print his picture only because the cut was crowded out of the issue containing the first article, and we hate to throw it away.



JOHN SASSO
. . . digging out data

FIRST LINE (ALT.)

There are those who argue that our traditional first line of defense is no longer first but second, with its place now occupied by the airplane. We are not convinced, but we do recognize the tremendous importance of planes, and the urgent need for boosting their output. One of the most vital links in the production chain is the precision parts supplier. Not only must he produce many parts to specification, but often must develop and manufacture complete units. Torn between production pressure and demands for precision, he occupies an unenviable position in the defense program. On page 876 R. J. Wenger, shop superintendent at Bendix Aircraft, gives an idea of the many headaches.



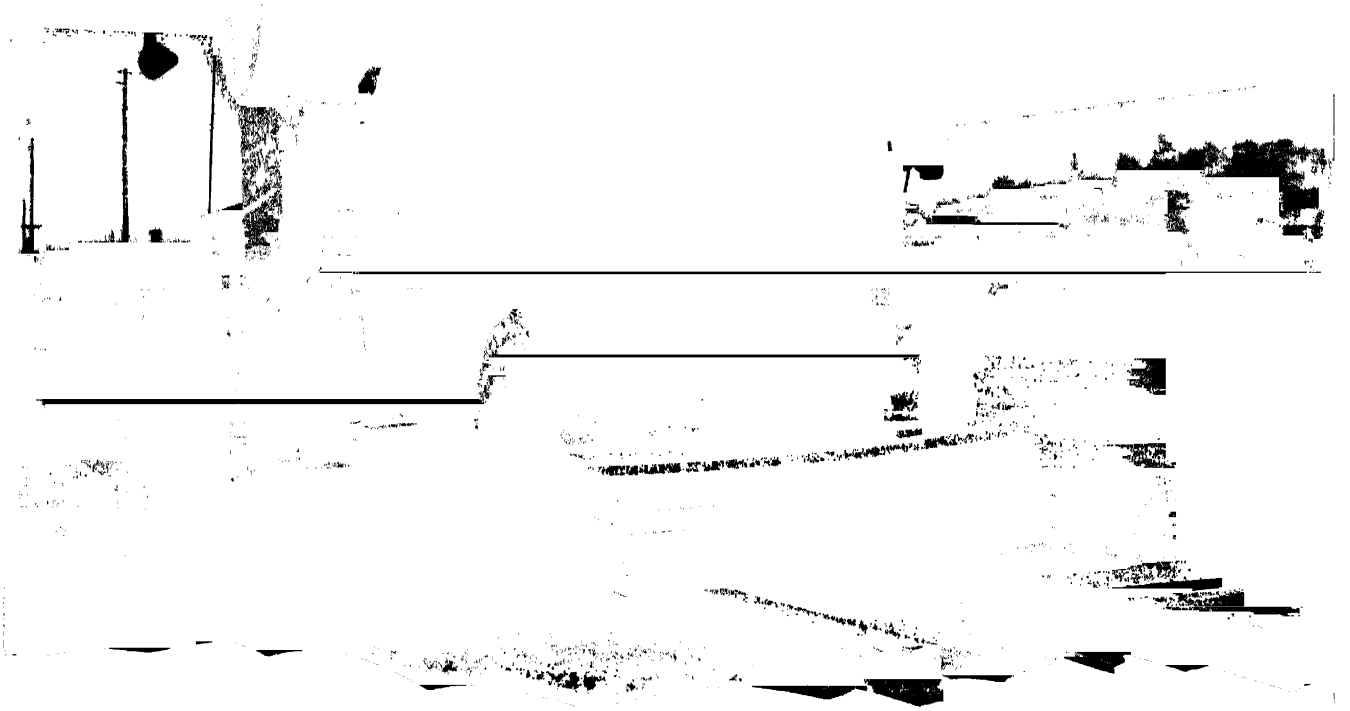
R. J. WENGER
. . . headaches, headaches

WHO MAKES FOR DEFENSE?

Who's got the contracts the Government's been awarding for national defense items? What are they for? How much is involved? When are deliveries scheduled? Offhand, the answers to these questions would seem to involve a statistician's nightmare. But they're not as bad as that. For believe it or don't, all that information has been squeezed into ten pages, beginning on page 879.

COMING

How's production on the Garand rifle coming along? What are some of the special operations involved? These and many other questions about the manufacture of this new weapon will be answered in an early Armament Section. Also scheduled are articles on copper brazing, carbide tools for steel, multiple-sheet profiling, and other phases of metalworking vital to defense. Look for them soon in AMERICAN MACHINIST.



Paid For Itself In Four Months

ON one job alone, required for the rebuilding of 1800 hopper cars, the above recently installed 400 series Cincinnati All-Steel Press Brake completely refunded the investment in four months.

● ● ● ● ●



At the left is another CINCINNATI PRESS BRAKE working for a railroad. Job illustrated—bending end on hopper chute. Records show that this unit has refunded the investment at least four times during its 3 years of service.

Every plan for modernization or new car construction should include the economies which can be effected with Cincinnati All-Steel Press Brakes.

Write for recommendations on your job.

THE CINCINNATI SHAPER COMPANY, CINCINNATI, O.

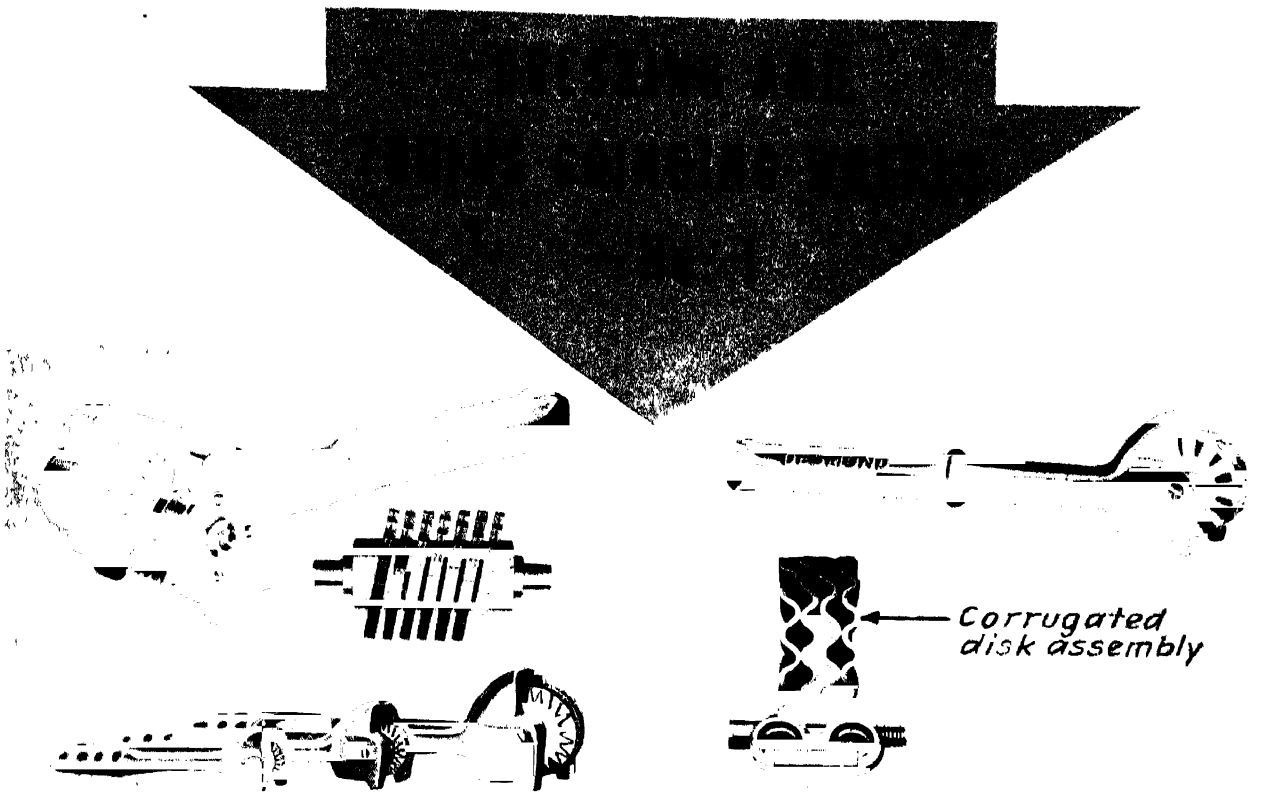


Fig. 1—(Left) Suitable for segmental surface grinding wheels, and for coarse grit wheels used for snagging and off-hand grinding, the Huntington dresser must be used carefully for best results. Fig. 2—(Right) The corrugated-disk dresser is used to smooth the faces of roughing wheels in many shops

Tools make the wheels go round

BY H. J. WILLS, ENGINEER, THE CARBORUNDUM COMPANY

A grinding wheel must be kept sharp like any other cutting tool. Also its shape must be correct. Here are some of the tools for truing and dressing

WHEN USED in connection with grinding wheels, the terms *truing* and *dressing* often are used interchangeably because the processes are similar. The real difference is in the purpose. Truing restores a wheel's concentricity and parallelism, or alters its shape. Dressing changes or maintains its cutting action.

While grinding wheels are more or less "self-sharpening," one which never needs dressing will wear too rapidly for economy, and will be too soft to give good finishes or economical production. A wheel well-suited to the job must be dressed often enough to keep it sharp—otherwise production will suffer. Dressing also restores the desired cutting action when the face of the wheel has become loaded with metal or other foreign material.

For production grinding, wheels should be dressed at regular intervals, whether or not there is apparent need for it. The period between dressings for each type of work should be determined by tests. If the wheel is permitted to become obviously dull or loaded before it is dressed, production will suffer; and because excessive wheel material must be removed at each dressing, its life will be shortened. Dressing and truing should be standardized as to frequency, tools used, and methods.

The Huntington, or *star*, dressers shown in Fig. 1 efficiently remove metal filling. It is suitable for segmental surface grinding wheels and for coarse-grit wheels used for snagging and off-hand grinding. It is inexpensive, but requires skill on the part of the operator for proper use.

The corrugated disk dresser, shown in Fig. 2, is similar to the star dresser, but because it will not give a very

open structure it is used solely to smooth the faces of roughing wheels. Fig. 3 shows a locked-disk type dresser which will true the face of the wheel flat and open the bond only slightly. Its use is limited to medium roughing wheels, but it has a wide field in dressing wheels for centerless grinding bars, bolts and similar products, and for cam and crankshaft grinding.

The Ross dresser shown in Fig. 4 is a solid steel cylinder whose surface contains one or two helical grooves or series of evenly spaced openings. This dresser takes the place of a diamond for jobs such as the fine grinding of cast iron, precision surfaces and finishes on tappets.

Abrasive sticks, either round for magazine mounting or square for hand use, are economical for truing and dressing wheels for roughing cuts, when a diamond is to be used to dress for subsequent finishing grinds. Either may be used to dress wheels for saw-gumming, tool sharpening, centerless profile grinding and for Blanchard surface grinder wheels.

The square abrasive stick is suited for toolroom wheels used for sharpening reamers, end mills and various other cutting tools. Magazine mounted sticks find use in forming wheels for profile grinding and for dressing and truing thin wheels.

A dresser which uses a silicon-carbide wheel as the dressing element is shown in Fig. 5. Such dressers often are used in place of diamonds for dressing wheels used for centerless grinding,* where commercially fine surfaces are required. These dressers give the wheel a clean-cutting, smooth face which will not leave dressing marks on the work. Their use does not call for much skill. Since they commonly are used without coolant, the operator can watch the action closely. However, if the grinding is done wet, a coolant should be used when dressing. Abrasive wheel dressers of this type are set at a slight angle to the axis of the grinding wheel, and are driven by contact with the wheel.

Diamonds for truing and dressing grinding wheels are of several types, each having different characteristics. Fig. 6 shows the construction of three typical diamonds. From left to right they are *octahedron, elongated* and *Ballas* (round). These sketches show the two and four point grain structure, and the "Was" (pronounced *Vaz*) The "Was" are flaky, unusable surfaces. Since the only usable parts of most stones are the points, the four point being the best, the diamond should be reset before the point is completely worn away. Once the point is worn away, the stone will wear much more rapidly and it will not properly dress the grinding wheel.

The decision as to when to reset a stone so as to expose a new point is chiefly a matter of judgment. Roughly, it should be done when the worn flat equals ten per cent of the exposed part of the stone. Gages for measuring this wear are available.

Diamonds are adversely affected by the heat generated when dressing grinding wheels. Also, overheating of the setting may cause the stone to loosen, which may result in costly diamond breakage or even total loss. For that reason, dressing always should be done with a copious supply of coolant. With the special holders shown in Fig. 7, the coolant flows around the metal directly behind the stone, thus keeping both stone and setting at a safe temperature.

If a diamond is presented to the wheel so that the wheel cuts directly across the lines of cleavage at a right angle, the stone will wear rap-

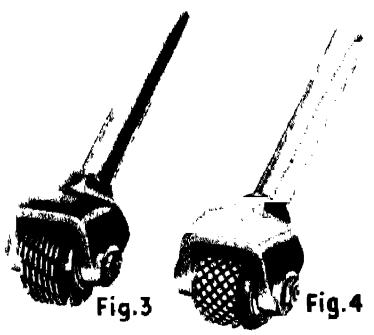


Fig. 3—Limited to medium roughing wheels, the locked-disk dresser will true the face of the wheel flat and open the bond slightly. Fig. 4—A solid steel cylinder whose surface is grooved, this dresser can be used in place of a diamond for dressing wheels used on precision work of all types

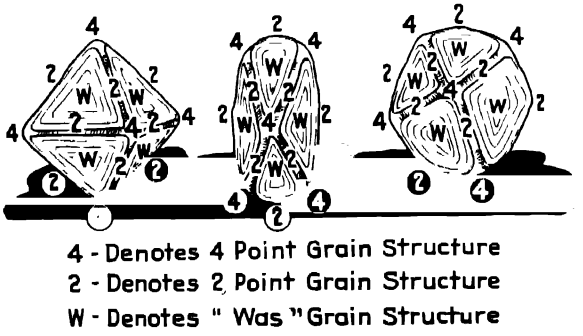
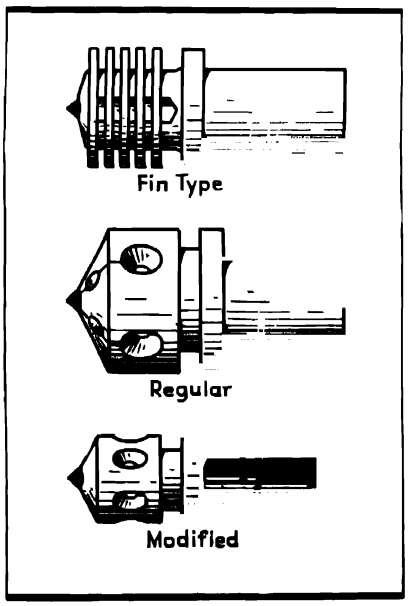


Fig. 6—Three typical diamonds used for truing and dressing grinding wheels. From left to right, they are octahedron, elongated and round stones



Fig. 5—Abrasive wheel dressers are driven by contact with the grinding wheel. Such dressers give the wheel a smooth, clean-cutting face which will not leave dressing marks on the work

Fig. 7 — Diamond holders of the types shown permit coolant to flow around the metal directly behind the stone, thus keeping both stone and setting at a safe temperature



idly, and may break. To prevent this, it is desirable to have the diamond approach the wheel at about a 60 deg. angle, so that the cutting action is along the line of cleavage. The holders shown in Fig. 8 permit such mounting, and so give a cool, clean cutting action.

To be fully efficient, an octahedral diamond must be reset to present a fresh point as soon as a point becomes dull. When all of the points have dulled, the stone is round and inefficient. Yet so much of the stone is left that there is a temptation to continue using it, even though the wheels are poorly dressed.

To secure even the limited efficiency that comes from utilizing the natural points by resetting is expensive. The total resetting cost may amount to a third or a half of the original cost of the stone. If the stone is set in molten metal, frequent resettings are apt to burn the diamond.

Tools are available which not only make resetting unnecessary, but permit practically complete consumption of the diamond while always having a sharp point or edge to apply to the wheel. Furthermore, since the original setting does not require the use of heat, the stone cannot be burned in setting. The setting can be ground by the wheel without weakening the support provided for the diamond.

The tool first is applied to the wheel at a slight angle, say 5 deg. When a flat develops the angle is increased, so that the ground edge formed in the first position is used. By frequently turning the stone and changing its angle, fresh points and edges are always available, without resetting, until the stone is entirely used up.

One tool which makes use of this principle consists of an elongated diamond set in a tungsten alloy. By mounting this tool in a special adapter, so that the tool is at a 30 deg. angle, and frequently rotating the nib on its axis, a sharp cone point is maintained. The entire stone can be consumed.

Another tool with an alloy setting which can be ground away, and which has the advantage of using small stones which cannot otherwise be completely consumed, is shown in Fig. 9. In this tool, several small stones are set in tandem When the first stone is ground away, the next one is exposed by grinding or by turning the setting.

Another setting which permits the efficient use of small stones is shown in Fig. 10. Here seven small stones are set in a single plane in such a way that two to four are in contact with the wheel simultaneously. Each stone does its share of the work. The stones maintain sharp points, and the multiplicity of points gives a finer dressing action while maintaining the free cutting action of the wheel. The tool is turned frequently to present the other stones to the wheel.

Somewhat similar in theory and action is the tool shown in Fig. 11, in which three diamonds are set in line. When the stones are ground flat on one side, the tool is turned over. Thus sharp edges are always available.

Fig. 12 shows a dressing tool which consists of a matrix impregnated with small diamonds. It is applied to the wheel at a 10 to 15 deg. angle. As the tool becomes dull it is given a quarter turn. Such tools are used only for finish dressing, and are suitable for wheels of any size, type or hardness.

The second article in this series by Mr. Wills will appear in an early number.

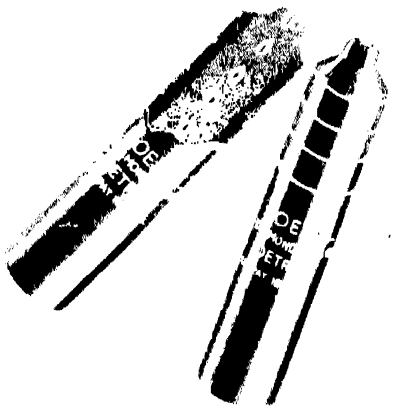


Fig. 9—Small stones are used economically in a tandem setting, such as the one shown. Stones are exposed by grinding away the setting

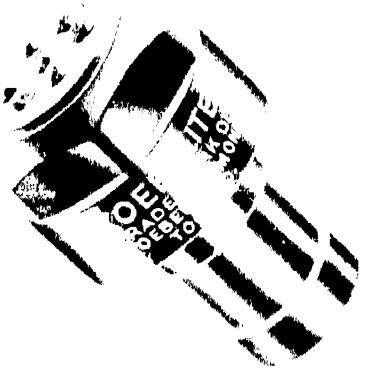


Fig. 10—Here seven small stones are set in a single plane in such a way that from two to four stones contact the wheel simultaneously

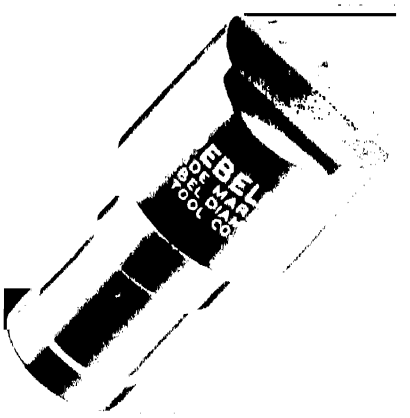


Fig. 11—With three diamonds set in line, this dressing tool is turned over when the stones are ground flat on one side



Fig. 8—These holders present the diamond dresser to the grinding wheel at a 60 deg. angle so that cutting action is along the line of cleavage

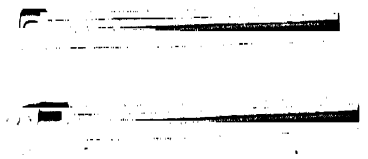
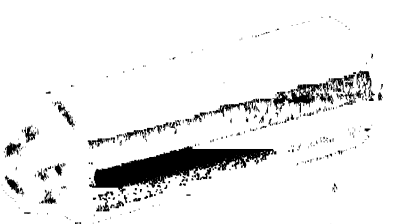
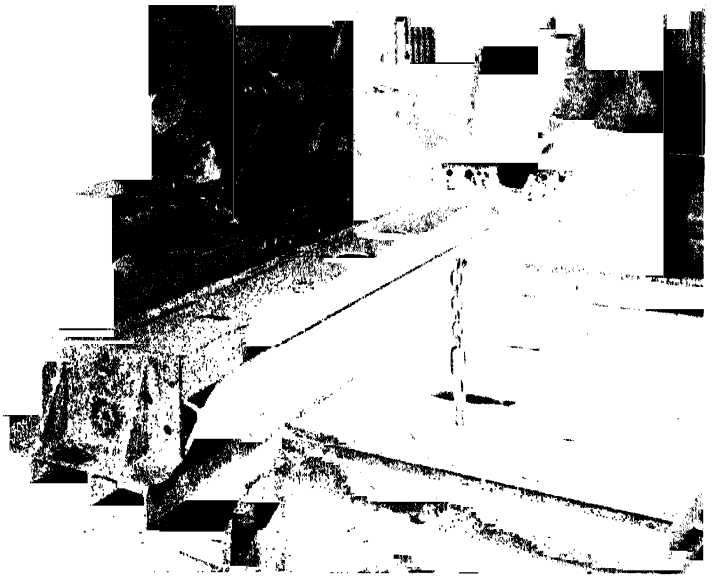


Fig. 12—A number of recently-developed dressing tools consist of a matrix impregnated with small diamonds. Such tools are used for finish-dressing all types of wheels





Low-cost

Combined welded and riveted construction of hopper cars makes quick repairs possible. Parts are jigged for hand and automatic welding operations

The bolsters, with web tilted so that the flange will conform to the slope of the end hopper sheets, are placed in jigs for welding side-bearing struts and side-connection plates; 36 lineal ft. of welding is used



The top and bottom side angles are placed in this jig, the side sheet bolted to the angles, and the side stakes positioned on the side sheets preparatory to automatically welding them in place. The automatic welding operation is in progress on an alternate jig in the left background

A gantry with two automatic welding heads supported from a travel carriage platform is used to weld both edges of the side stakes to the side sheet simultaneously. The welding head is thyratron controlled. Welding and rapid traverse movements are pushbutton controlled



freight cars

BY J. W SHEFFER, AMERICAN CAR & FOUNDRY COMPANY

RECENTLY the Chesapeake & Ohio Railroad built 100 hopper cars of 50-ton capacity, using combined welded and riveted construction. The underframes, sides and ends were subassembled by welding, and riveted at their respective lines of attachment during final assembly This method was adopted not only for economic reasons but also to speed production and facilitate repairs to side, end and floor sheets which are subject to severe corrosion during the service life of the cars

The underframes, sides and ends were subassembled with the parts jigged in a flat position to avoid vertical and overhead welding Much of the welding was accomplished with a gantry type unit having two automatic welding heads supported from a travel carriage platform and properly positioned to apply single beads along the side sheets, and beads on two sides of each side stake simultaneously The welding head of the machine is thyratron controlled, with pushbuttons for all welding and traversing operations Hand welding was done with $\frac{1}{4}$ in and $\frac{5}{16}$ in shielded arc electrodes, while automatic welding was done with $\frac{1}{16}$ in electrodes in reels mounted on the gantry unit

In final assembly, welding was used principally at joints in contact with the lading, and at upper flanges of center sills Riveting was used at other locations About 900 lineal feet of welding was used on each car, this being mostly butt and fillet welds of continuous and intermittent beads

Light weight was not a prime objective in building the cars, and the weight saved by the use of welded construction was replaced by increasing the thickness of the floor and hopper sheets, which members are subject to greatest deterioration Welding permitted the floor, center ridge and hopper construction to be made smooth, thus facilitating the flow of the lading Maximum capacity without exceeding clearance limits were attained by welding pressed steel side stakes on the inside of the side sheets and by building up the end sheets in arch form

The center sill construction utilizes A A R twin Z-bars weighing 41 19 lb per ft The bolster center fillers and rear draft lugs, as well as the striker and front draft lugs are of cast steel secured by rivets The center plates are drop forgings held by rivets Each body bolster is a 21-in. 59 lb H-beam, placed on the top of the center sill construction, having its



The side sheets, with bottom angle bolted in place, are welded, drilled, reamed and riveted in one of the subassembly operations. After the side stakes are welded to the side sheets, this subassembly is riveted to the underframe and ends



In the first main assembly position, the bolsters are fitted to the center sills and the side-bearing braces, floor-post gussets, diagonal-brace gussets and air brake valve supports are welded in position Finally, the cross-ridge subassembly is fitted to the end and center sills



At succeeding positions on the erection track, the sides and ends are applied, as well as miscellaneous items such as corner caps, sill steps, ladder stiles, hand brakes, steps, and stake closures Parts of the cars subject to severe corrosion are riveted to facilitate replacement when necessary Most major subassemblies are of arc-welded construction

top flange tilted to the angle of the end floor sheets. The cross-ridge construction was built up as a unit including the inside bracing, its final application to the car being mainly by rivets. The hopper doors are of pressed steel and so shaped to obtain a tight closure.

The principal dimensions and weight of the cars are as follows: Length over strikers—53 ft. 11¾ in.; length inside—33 ft ; center-to-center of trucks—24 ft.; width over-all —10 ft 5 in ; width inside—10 ft. 4 in.; height over rail—10 ft. 6¼ in.; capacity—50 tons and 2,081 cu.ft. level full; light weight—41,500 lb.; load limit—127,500 lb.

This outline of welded-riveted hopper-car construction illustrates the economics which must be considered by the designer, by the shop in its assembly of the cars, and by the railroad in its future repairs

Portable Work Bench and Tool Box

AIRCRAFT PLANTS are often confronted with the necessity of working on airplanes on the flying field or in the hangar. Some of this work may involve installation or removal of parts which have been riveted into the structure. The problem is to get the necessary tools for the mechanic and his helper out to the airplane. Not only must the quantity of tools be so complete as to save unnecessary trips back to the shop but provision must also be made for power operation of some of these tools The cart shown in the illustration was developed at Wright Field to take care of almost every contingency in connection with working on every part of the airplane except the engine.

Mounted on three air-filled rubber-tired wheels the cart has one drawer in which are kept sheets of various thicknesses of aluminum alloy for possible reinforcing jobs, other drawers containing gages, scales, drills and smaller tools. Screw drivers, shears, hand drills and other tools are held by fabric strips inside the cover. Larger tools including those needed for riveting are kept inside the cart. A thick sheet of aluminum alloy is hinged to one of the covers so as to provide a small-sized bench. Square tubing, which is normally carried inside the cart, is used to brace the bench. A reel on the back carries 100 ft. of cable for making connections to the power supply.



Every tool needed for making installations or repairs on the structure of an airplane has a place in this cart, the top of which forms a convenient work bench. The cart is made of welded and riveted sheet metal and may be closed to be moved from shop to flying field or hangar



Merely posting notices forbidding pranks doesn't relieve an employer of responsibility. He'll probably pay the bills if someone gets hurt

No horseplay!

BY LESLIE CHILDS

CONTENTED, CHEERFUL WORKMEN are assets to any industrial plant. So long as pleasant attitudes spring from a wholesome exchange of verbal badinage all may be well. But where exchanges of this kind take on the color of horseplay involving physical contacts, prudence counsels their discouragement. For if injury results, as is often the case, chances are that the employer will be held responsible.

Especially is this true where there is evidence that the employer made no effort to curb the prankish activities of his employees, and they became traditional in the plant. Courts take this into account, and an employer can rarely escape liability for injury arising from it. The danger in overlooking this phase of industrial management is illustrated in a long line of cases.

In one instance certain plant employees fastened an electric wire to an iron door, so that when anyone touched the door he would receive a shock. This prank had been played frequently on various employees under the eyes of a foreman, and the employer apparently enforced no rules against it. It was all done in fun—no harm to anyone was intended. But one employee suffered severe injury from shock when he came in contact with this door, and the court in affirming a judgment against the employer for the injury reasoned:

" . . . while ordinarily a master is not liable under the compensation act for injuries to a workman which have been caused through the mischievous pranks and sportive jokes of his coemployees, yet the rule is otherwise where the master has knowingly permitted such mischievous pranks to continue. In such case the danger of injury becomes an incident of the employment . . .

"The serious contention in this case is that the master did not know that such pranks were being perpetrated on its premises. It would not be unjust to say that the master should have known and was chargeable with notice, for the same mischievous and dangerous prank had been practiced frequently on other workmen off and on for several weeks or months before plaintiff was injured. Here . . . it was shown that plaintiff's foreman, the man who directed his work, was one of the perpetrators of the mischief which injured the plaintiff.

"This foreman knew this particular prank had become a custom on the employer's premises . . . and his knowledge of the electrical mantrap on the door was notice to his principal."

The importance of an employer's taking a stand against horseplay upon his premises is evident. But, to be effective, the stand must be positive. Mere posting of rules, unless enforced, will rarely avail an employer in defense against an action growing out of an injury of this kind.

For instance, another company announced rules forbidding horseplay by its employees while upon its premises. These rules, however, were not enforced effectively. Despite them, a workman suffered a fatal injury resulting from application of an air hose to his rectum by another employee. In holding the employer liable for damages, the court said:

"In appears from the record that during the forenoon of that day, and perhaps on other days, there had been 'horseplay' among the workmen. . . . It was stipulated by the parties on the hearing that 'the company did not tolerate horseplay,' and this stipulation is, of course, binding. There is evidence, however, from which the commission may have reasonably found that the supervision and discipline were lax and less than required by the type of men employed for the work and entrusted with the appliances being used . . .

"It is clear that injury occurred at a place where [the workman] was required by his employment to be, at a time while he was actually engaged in that employment and performing his duties as required by his employer; . . . he was therefore injured in the course of his employment. All of the causative factors of his injury were incidental to that employment, so that it must be held that the injury arose out of his employment."

The foregoing cases aptly illustrate the reasoning followed by the weight of authority in situations of this kind. In the light of this, an employer who knowingly permits horseplay by his employees upon his premises is, to say the least, taking uncalled-for risks. As proof, the law reports are freighted with cases of this kind, growing out of tricks, pranks and jokes, the consequences resting upon the employer since he pays the bills.

A box-section in one stroke

BY L. KASPER

AN ARRANGEMENT designed to form a sheet-metal box-section with each stroke of the press uses a forming punch of irregular shape and a cam-operated slide to move the pieces from one position of the die to the next.

The punch holder carries the forming and shearing punches and a cam, see Fig. 1 which shows the ram in the top position. A spring which is not shown in the drawing holds the roller on the slide against the cam face.

Material is fed into the die in the direction shown by the arrow, Fig. 1. As the ram descends the shear cuts the material to the proper length. The slide remains at rest until the roller reaches the incline on the cam when the slide is drawn to the rear by its spring. The wider portion of the forming punch forces the material into the wide part of the groove in the die forming a channel section. The distance between the two projections on the front end of the slide is such that the narrow section of the punch can pass through on the down stroke, see Fig. 2, and make the bends to finish the box-section.

As the ram ascends the roller moves on the incline toward the high spot of the cam causing the slide to move forward. The solid portion of the slide moves the channel-shaped piece forward under the narrow portion of the punch ready for the next down stroke of the ram. At the same time the projections on the front of the slide strip the finished piece off the punch as it rises. When the roller reaches the high point of rest on the cam the piece is completely stripped from the punch and drops through the hole in the bolster plate.

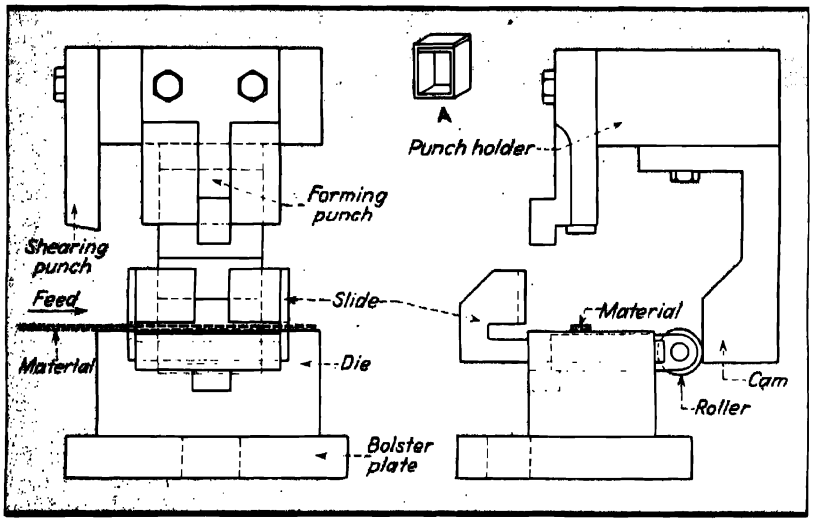


Fig. 1—Ram is in top position with material lying on top of die ready for forming into box-section in A. Stop, guides and stripper have been omitted to avoid confusion

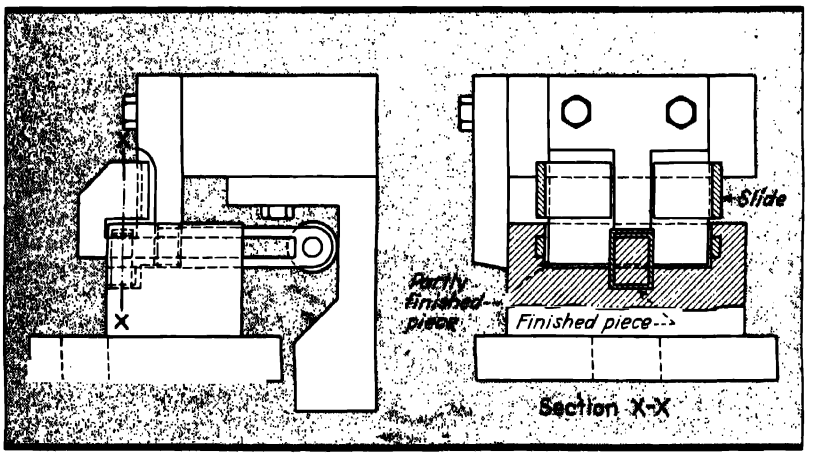


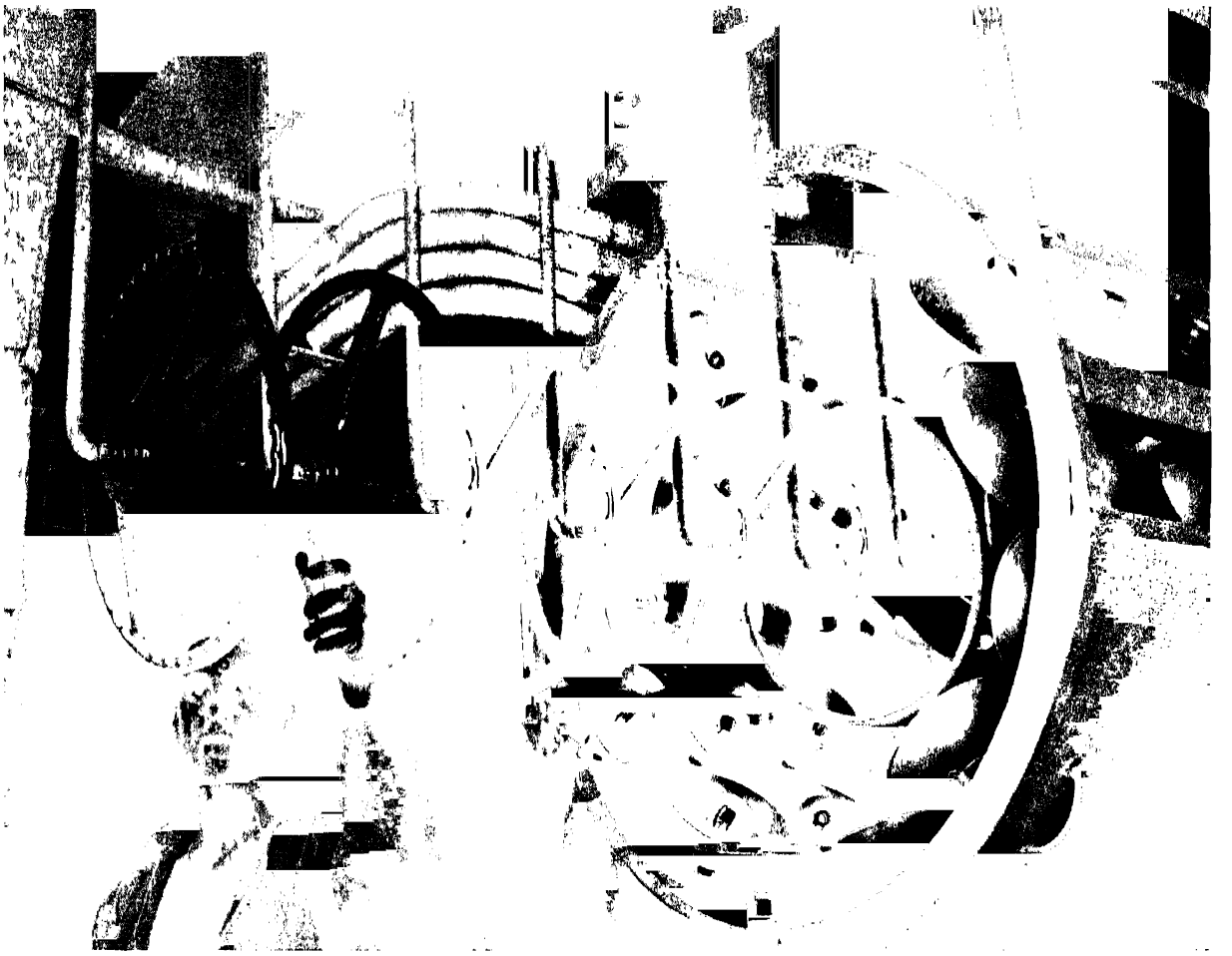
Fig. 2—Side view of the die with the ram down shows the finished piece on the front of the punch and the partly finished piece in the die under the wide rear portion of the punch

Belt Grinders

BY JOHN R. GODFREY

ABRASIVE belts are now so common that few realize how comparatively new they really are. Of course, the old buffing strap is ancient history. But the abrasive belt, running over two pulleys and supported under the work by a flat plate, belongs to this century. It was in the early 1900's that John C. Blevney phoned me to come and see him in his little shop in Newark. It was the same shop in which he built a few steam driven automobiles at about the turn of the century.

John was using sand paper at the time, which didn't seem practicable but did very well at that. Handing me a pointed steel rod he invited me to jam the point against the belt. Instead of ripping a slit in the belt as I expected, the end of the rod seemed to melt away like magic. This, to the best of my knowledge, was the beginning of what is now a standard machine. Sandpaper soon gave way to cloth backed abrasives, and these have also been greatly improved, as well as the machines.



Steering wheel finishes lend themselves readily to drying by radiant heat This infra red tunnel is used by the Ford Motor Company

Infra-red in industry

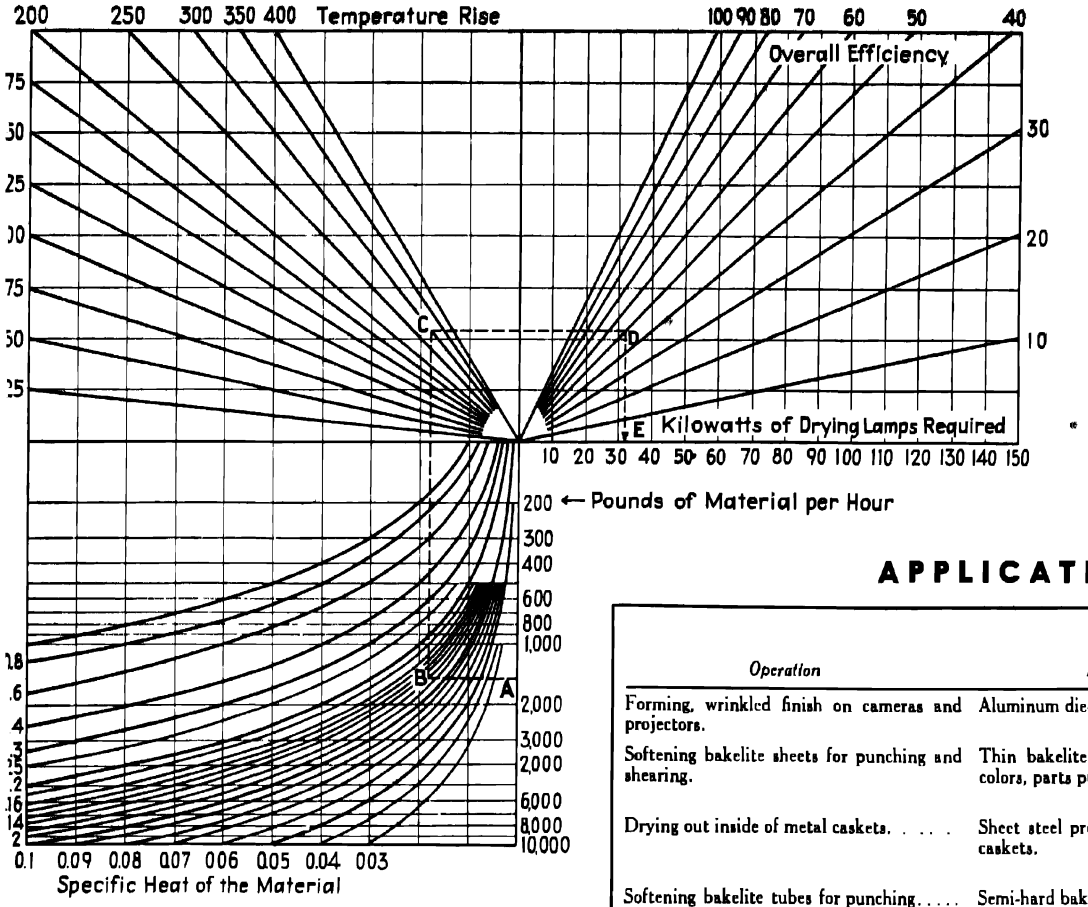
BY JOHN SASSO

Anyone who sits in front of an open fire knows the effect of radiant heat. If he reads this article at the same time he will learn of its growing application to metal finishes

FORD HAS USED infra red heating in expanding pistons for inserting piston pins One outboard motor manufacturer is reported to have used the method in making shrink fits In the latter application, concentrating reflectors were found better than the parabolic type However, much time was required by this method Handling of plastic sheets has been simplified by softening them with infra red lamps instead of in ovens prior to punching or forming Fiber board is also successfully heated and softened prior to bending to shape These are but a few applications of the principles of radiant heating discussed in a previous article (*AM*— Vol 84, page 741)

Infra red heating has the advantage over air or oven drying in that heat is instantly available with the lamps whereas some time is required to bring the parts and oven up to working temperature The prime coat on Ford bodies is baked in fifteen minutes with infra red lamps as compared to sixty minutes required by a steam oven that was replaced Finishing coats require about twice as much time as prime coats with even greater saving over previous oven drying schedules Comparisons of baking times between lamp ovens and conventional ovens may be misleading since often there are special conditions which favor one method against the other

It has been pointed out by the American Gas Association that any baking results obtained with electric infra red lamp equipment can also be obtained with gas equipment at a comparable cost and, it is claimed, with certain definite advantages Ra



Approximate kilowatts of lamps required for mass heating. Starting with the weight of material at A *proceed to specific heat* B, *vertically to the temperature rise* C, *across to overall efficiency of lamp bank* D *and down to the kilowatts required* E

diant gas burners have satisfactorily dried white urea-formaldehyde finishes, usually difficult to dry successfully with electric equipment.

Usually lacquers and quick-drying enamels can be dried rapidly. Occasionally, however, it is just as difficult to eliminate the slight tack of synthetic lacquers as it is to bake a true baking enamel because of the time required for oxidation. The fast-drying enamels best suited for lamp drying are made with short oil modified alkyd (glycerol phthlate) resins which may be further modified with urea-formaldehyde resins if greater hardness is desired. If high enough intensities are available, non-drying alkyd and urea-formaldehyde combinations are useful.

Space saving with infra-red heating may amount to as much as 50 per cent. A 15-kw. infra-red installation of 250 watt lamps required a floor space of about 30 sq. ft. as compared

APPLICATIONS OF

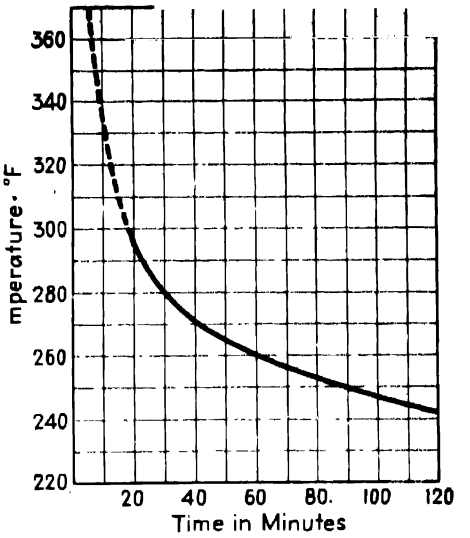
Operation	*Material*
Forming, wrinkled finish on cameras and projectors.	Aluminum die-cast metal
Softening bakelite sheets for punching and shearing.	Thin bakelite sheets, black and tan colors, parts punched out.
Drying out inside of metal caskets.	Sheet steel pressed and welded burial caskets.
Softening bakelite tubes for punching.	Semi-hard bakelite
Baking out radio coils and transformers.	Electrical coils and windings on fiber or bakelite cores.
Enamel baking on small metal stampings	Sheet metal display with pressed pocket for advertising.
Removing cyanide from pits and pores in castings.	Gray cast iron
Baking finish on transformer cases.	Pressed sheet steel boxes (22 gage)
Drying adhesive lacquer or glue on speaker cones.	Steel frame and paper cones
Laboratory use — baking finishes on cans	Tin cans, labels and decoration printed directly on tin.
Expanding pistons to permit dropping pins in place.	Aluminum alloy pistons
Softening bakelite for punching and shearing.	Bakelite strips from which small parts are punched by press.
Drying paste to hold jewels in place	Plated brass and die cast metal
Baking enamel finish on globe valves	Cast or wrought iron and brass
Baking wrinkled finish on die-cast auto heater cases or frames.	Die-cast frame or case for auto hot water heater.
Baking enamel on molded bakelite radio cabinets.	Small portable radio cabinet of molded bakelite — mottled brown color.
Baking out synthetic urea formaldehyde enamel on metal.	Test samples of steel sheet
Drying ground coat preparatory to firing on at high temperature.	Steel sheet
Drying first finish coat on fired ground coat	Steel pan with vitreous ground coat fired on.
Baking synthetic enamels on small axe blades.	Steel axe blades
Dehydrating or drying Tenite preparatory to molding.	Tenite (a plastic) granules, various grades and colors.

* From investigations of radiant energy heat made by the Commonwealth Edison Company.

to 64 sq. ft. for a 15-kw. strip heater oven. Flexibility is secured by cutting banks of light in and out as required; and lights are adjustable to any direction. Distance of the lamps from the parts is usually adjustable for the full effective range of the lamps. Small banks of reflectors are mounted on rollers and used for spot drying of finishes in both automotive and aircraft manufacture and maintenance. Initial cost of infra-red installations is comparatively low. Maintenance is confined to replacement of lamps and cleaning reflectors. Further, the installations can be dismantled and rebuilt to suit new requirements.

The time of baking paint is shortened by increasing the temperature; but since most organic pigments tend to fade at elevated temperatures, caution must be exercised. (Graphs are from a paper by Howard Haynes, Nela Park Engineering Department, General Electric Company, before the Illuminating Engineering Society)

Information and data used in this article are based on information by Howard Haynes, General Electric Company; H. J. Bennett, the Glidden Company; Eugene R. D'Olive, Commonwealth Edison Company; Hale A. Clark, Michigan Consolidated Gas Company.



RADIANT ENERGY HEATING*

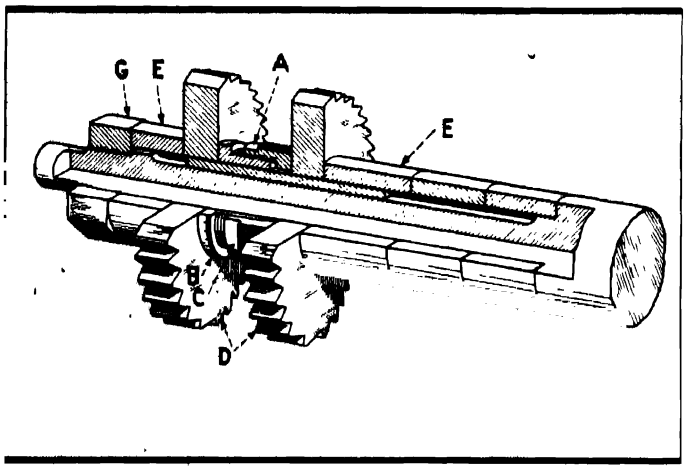
Size in In.	*Finish*	*No. and Size of Lamps*	*Total Watts*	*Reflector Diameter and Spacing In.*	*Reflector Finish*	*Distance in In. of Filament From Work*	*Time Under Lamps*	*Watts/Sq. In. on Work*
2 x 4 x 6	Synthetic plastic wrinkle finish sprayed on.	4 — 250W Tungsten	1000	8 1/4 dia. 9 1/2 spacing	Alzak	8	6 min.	2.75
3 x 4 ft. 1/8 thick	None — softening	16 — 240W Carbon	3840	8 1/4 dia. 8 1/2 spacing	Alzak	12 to 24	3 1/2 sec. Cont. after 2 min. preht.	0.9
16 x 24 x 72 Approx.	Plated or oxidized surfaces from which moisture must be removed on inside.	10 — 260W Carbon	2600	None — special arrangement	None	3 to 8	5 to 10 min.	0.40
3 dia. by 16 x 1/16	None — softening.....	8 — 240W Carbon	1920	8 1/4 dia. 8 1/2 spacing	Alzak	12 to 18	Continuous after 2 min. preheat.	1.2
3 dia. x 2 long	Insulating varnish impregnation	16 — 260W Carbon	4160	8 1/4 dia. 8 1/2 spacing	Alzak	10 avg.	4 min.	1.6
4 x 6 x 1/32	Red enamel sprayed on.....	16 — 260W Carbon	4160	8 1/4 dia. 8 1/2 spacing	Alzak	12	12-15 min.	1.33
10-14 dia. 1 1/2 x 2 height	Plating after wash in cyanide and hot water.	24 — 260W Carbon	6240	8 1/4 dia. 8 1/2 spacing	Alzak	7 varied	20 min.	3.2
3 x 3 x 4	Black nitro-cellulose lacquer with solvent — 5 min. air dry, 10 min. under lamps, 10 min. air.	30 — 260W Carbon	7800	10 dia. 12 spacing	Gold	8	10 min.	3.50
6 dia. cones 3 height speaker	Nitro-cellulose adhesive lacquer.	88 — 260W Carbon	22880	7 1/2 & 9 1/4 dia. 7 1/2 & 9 1/4 spacing	Gold & Color Alumilited	8	Continuous — 2 ft. per min.	2.40
2-3 dia. 4-5 height	Enamels, lacquers, inks.....	3 — 260W Carbon	780	9 1/4 dia. 9 1/4 spacing	Gold	Not known	Laboratory use	Varied
4-5 dia. 6 height	None — Expanding metal operation.	4 — 260W Carbon	1040	7 1/2 dia. 7 1/2 spacing	Color Alumilited	6	3 min.	2.25
2-3 x 48	None — softening.....	16 — 260W Carbon	4160	7 1/2 dia. 7 1/2 spacing	Color Alumilited	14	Continuous after 2 min. preheat.	
1/2-1 dia. 1/16 thick	Jewelers' paste.....	2 — 260W Carbon	520	None - in inclosure	None	Not known	5 min.	Inclosed
Up to 1 1/2 valves	Green air dry enamel.....	8 — 260W Carbon	2080	8 1/4 dia. 8 1/2 spacing	Alzak	6 8	5 min.	2.75
10-12 dia. 4 1/2 height	Wrinkled finish enamel — grayish tan color — wrinkle formed in 3 min.	32 — 260W Carbon	8320	8 1/4 diameter 8 1/2 spacing	Alzak	10 12	9 min.	3.7
6 x 8 x 14 1/8-1/2 thick	Urea formaldehyde baking (220 F.) cream color.	32 — 260W Carbon	8320	8 1/4 diameter 8 1/2 spacing	Alzak	8-12	9 min.	3.7
3 x 6 (18 gage)	Synthetic enamel, urea formaldehyde, air-dry enamel — Chinawood, soya and meleic oils.	8 — 260W Carbon	2080	8 1/4 diameter 8 1/2 spacing	Alzak	12	7 min.	1.8
12 x 12 20 gage	Water solvent ground coat gray color.	24 — 260W Carbon	6240	8 1/4 diameter 8 1/2 spacing	Alzak	10	9 min.	2.6
7 x 15 x 4 1/2 deep — 20 gage	Water solvent white first finish coat.	24 — 260W Carbon	6240	8 1/4 diameter 8 1/2 spacing	Alzak	10	5 min.	2.6
3 x 5 3/4 Blade edge to 3/4	Gloss black synthetic enamel and thinner.	8 — 260W Carbon	2080	8 1/4 diameter 8 1/2 spacing	Alzak	12	15 min.	2.2
1 layer in pan 22 1/2 x 30 x 3 1/2	No finish — moisture removal..	8 — 260W Carbon	2080	8 1/4 diameter 8 1/2 spacing	Alzak	30	20 min.	0.8

IDEAS FROM PRACTICAL MEN

Adjustable Collar Aligns Straddle Mills Quickly

By S. M. ELONKA

Setting up a milling machine for a straddle milling job is usually quite tedious. After the cutters have been properly spaced and a cut is taken, it may be found that several thousands must be removed or placed in between the cutters. That means lifting the



An adjustable collar between straddle mills can be used for the precise setting of the cutters. Shims are eliminated, and set-up time reduced materially

milling machine arm, removing the nut, collars, and at least one cutter. Finally, it is difficult to find a shim or collar. Final adjustments often require the making and application of suitable shims.

The illustrated adjustable collar *A* eliminates such difficulty and permits rapid adjustment of the straddle mills. The collar consists of male section *B*, which has a calibrated knurled collar, and female section *C*. For maximum strength and minimum strain on female collar *C*, buttress threads should be used, preferably 16 threads per inch. If standard V-threads are used, the female collar will eventually expand due to lateral pressure and the wedging effect of the V-threads. After parts *B* and *C* of the collar are machined, graduated and knurled for easy manipulation, they should be case hardened.

If a key is used to hold the cutters on the arbor, then part *C* of the adjustable collar should be large enough to clear the key on the mandral.

The straddle mills *D* mounted on the arbor with solid collars *E* and with the adjustable collar *A* between the cutters, it is only necessary to loosen the nut *G* and adjust the knurled collar *B* to the desired number of thousands which are graduated on the collar. Thus, much time can be saved in adjusting the cutters.

Converting a Planer Into a Boring Mill

By C. C. HERMANN

The work shown in Fig. 1 should have been done on a large vertical boring machine. Since such a machine was not available in this shop, a 60-in. x 60-in. x 18 ft. Detrick & Harvey planer was fitted with the illustrated device to machine radii up 15 ft.

The work being machined consists of a die block support with a radius of 72 in., is $35\frac{1}{2}$ in. high and has a chord of 72 in. It is cast steel and weighs approximately 400 lb. The curved surface must be rough machined and finished. Finally a series of grooves must be cut across it parallel to the axis so that the finished surface will resemble a gear. The estimated machine time using the device shown in 100 hours which compares favorably with estimates for the same job on a vertical boring mill.

The device is designed to convert the longitudinal motion of the planer to circular motion of the work. Although not entirely new, it is novel and can be applied to other reciprocating machines. Similar parts in the illustrations are shown by the same letters.

The work is shown at *A* mounted on a base casting



Fig. 1—This device, used for machining a die block support with a radius of 72 in., converts the planer motion to circular motion of the work

B and backing up member *C*. The base plate *B* is bolted to two 5-ft. T-iron sections shown at *D*. A pivot *E* is mounted on a base block *G* which in turn is secured to a bedplate permanently installed in the concrete floor. This bedplate is machined with T-slots so that the pivotal point can be moved to accommodate different radii. The radius may be adjusted from 4 ft. to 15 ft.

Parallel bars *H* are secured to the planer table for

the bottom of the base plate *B* to slide upon. A link *J* is pivoted to the base plate *B* at its center. The opposite end of this link pivots on the planer table.

It is obvious that as the planer table moves the fixture is pulled in the direction of motion by the link *J*. The fixture must move in a circular manner since it is pivoted at *E*; therefore, any point on the work face passes the tool at exactly the same distance from the pivot. In the case shown, the tool on the planer column is doing the work on the face of the segment; however, the top tool on the planer arm may be brought down to plane the top surface as well. The weight of the work is heavy enough to keep it down on the table, although provision is at hand to weight or fasten the fixture where this is not the case by laying weights on the ledge of the back plate *C*. The operation of the planer with respect to speed, feed and quick return motion is normal. The distance of bed travel is adjusted to the work requirements.

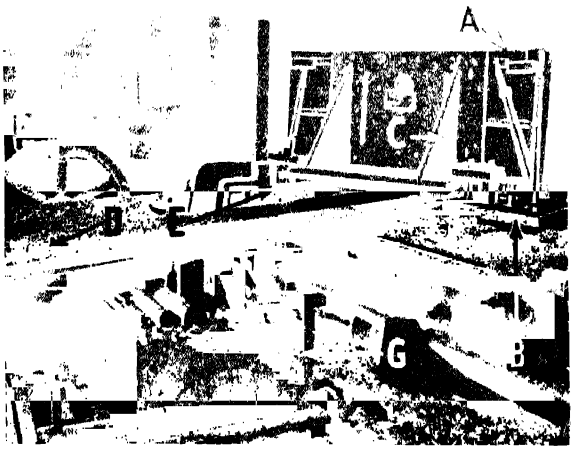


Fig. 2—As the planer table moves, the fixture is pulled in the direction of motion by the link pivoted at the base plate adjacent to the planer; therefore, any point on the work base passes the tool at exactly the same distance from the pivot

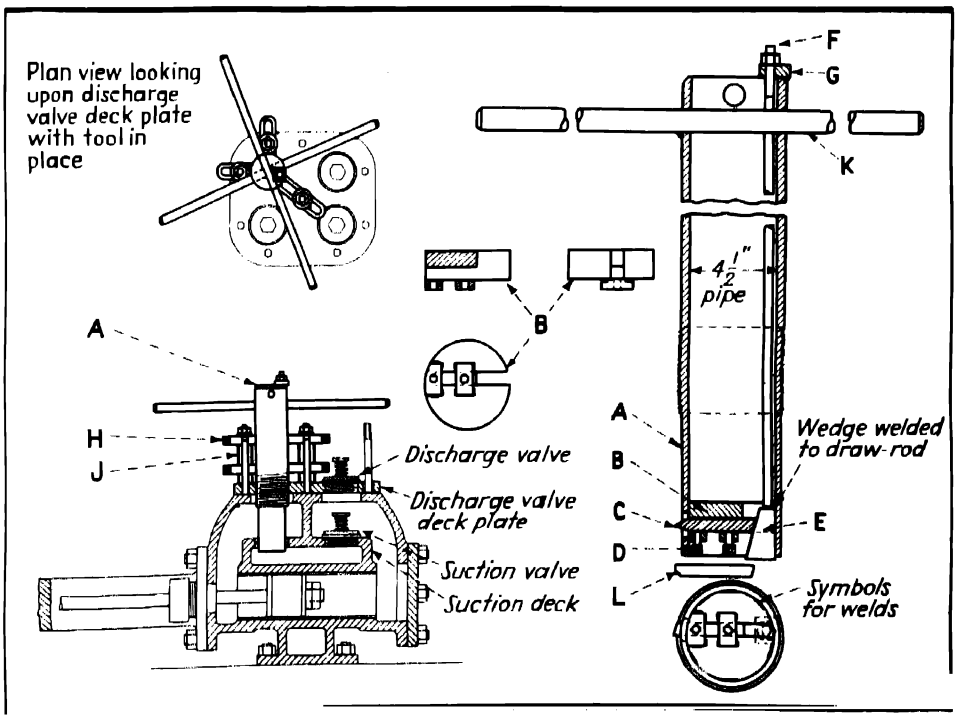
Improvised Boring and Threading Tools

By EMIL WITTMANN

A suction-valve seat in the liquid end of duplex steam pump will jump out of its seat when the threads in the suction deck corrode. The tools shown in the drawing were designed and built to rethread the suction-valve seat without dismantling the pump.

With the head of the pump removed and the discharge valve seat above the defective suction valve taken out of the discharge deck plate, a piece of pipe *A* is threaded to fit the threads in the discharge deck plate. In the lower end of *A* is welded a disk *B* with a groove snugly fitting a tool bit *C* held by two setscrews *D*. The tool bit is clamped lightly by the two setscrews but permitted to be forced outward for controlling the depth of the cut by a wedge *E* located in a slot of *B* and actuated by a draw rod *F* extending through to the top of *A* through a guide piece *G* welded to *A*. With *A* screwed into the discharge-deck plate of the pump, strap clamps *H* are arranged in sets of three each as indicated and spaced by pipe nipples *J*. These serve as a steady rest for *A* which is revolved by hand using the handle bars *K*. When *A* is revolved, it feeds downward causing *C* to cut a thread of larger diameter but of the same pitch as in the deck plate.

Only few succeeding cuts are necessary to produce a full thread. Between the cuts, the tool bit is forced outward approximately 0.005 in. by tightening the



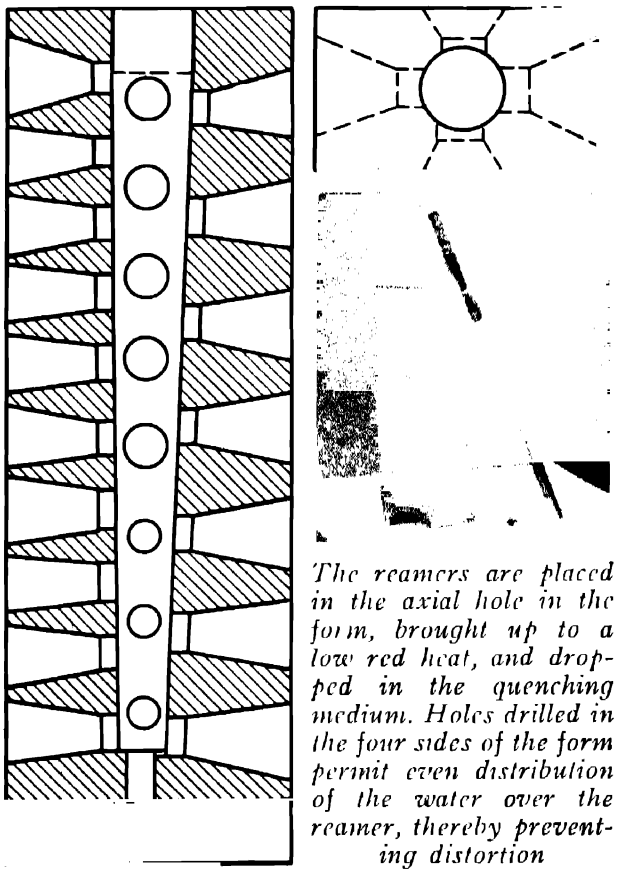
These boring and threading tools were designed to rethread the suction valve seat of a duplex pump, making it unnecessary to dismantle the pump while making repairs. The threads are cut in the suction deck as the threaded tool holder is advanced through the discharge deck

nut on top of *F*. A boring operation with a tool bit *L* precedes the threading operation. The threads on the outside of the suction valve are built up by brazing and the threads recut in a lathe to fit the threads in the suction deck.

Slender Reamers Not Ground After Hardening

By GEORGE J. MURDOCK

A considerable number of slender reamers are constantly required in one of our manufacturing operations. The cost of making the reamers had been so high by the common method of hardening and grinding the tapers afterwards that it was desired to reduce this expense without impairing the necessary accuracy. This was attained as follows:



The reamers are placed in the axial hole in the form, brought up to a low red heat, and dropped in the quenching medium. Holes drilled in the four sides of the form permit even distribution of the water over the reamer, thereby preventing distortion

A master reamer of the correct size—4½ in. long, 0.160 in. diameter at the top of the tapered part, and 0.140 in. at the bottom end, with a 0.125 in. pilot—was made with five cutting edges designed to make a shaving cut by milling the flats slightly concave the entire length of the taper. It was hardened, tempered and ground in the usual way.

A rectangular piece of machine steel, to be used as a hardening form, was then made somewhat longer than the taper part of the reamer. It was bored axially slightly smaller than the reamer, but to the same taper. The top of the hole was straight for a distance a little more than the length of the flats on the shank, and was made slightly larger than the shank. The hole in the bottom for the pilot was also enlarged slightly. The master reamer was then introduced into the bored hole, and the taper reamed until the end of the flutes above the pilot struck bottom.

Holes were drilled from all four sides into the central hole and countersunk nearly to the bottom. These holes were staggered so that they did not enter the taper from opposite sides but nearly midway between each other, those at the bottom being somewhat smaller than the ones at the top. After this hardening form had been completed it also was heat-treated to remove the strain due to machining.

A number of reamer blanks turned accurately to size but not hardened, were held in readiness after they had been stress-relieved by annealing to remove machining strains. One of the reamers was then tapped lightly into the form, leaving the part of the shank above the flat exposed about ½ in.

The form and reamer were then placed in a muffle, so as to exclude air, and brought to a low red heat after which the plug was knocked out and it was quickly dropped into cold water. On removing the reamer it was found nearly bright. The holder was a little discolored due to the inability of the oxygen in the air to reach it in the muffle.

When checked, the reamer was found to be as straight as before hardening, and of the required temper, the latter having been obtained by regulating the temperature of the water into which it had been dropped. When subjected to service the reamer lasted longer than those that had previously been ground after hardening, for grinding invariably sets up unequal strains on a ground surface.

After it had been found that a better and less costly tool could be made in this manner, several of the hardening forms were made so that six of them could be placed in the muffle at one time, thus further reducing the cost. Due to the comparatively low heat and the ease with which the hardening water entered the holes in the hardening form, it has been found that as many as 200 reamers could be hardened in a single form before it became necessary to renew it.

Since the successful application of hardening forms made on the principle described, it has been applied with equally good results to prevent distortion in a large variety of slender work that had formerly been ground after hardening, and with a corresponding saving in cost.

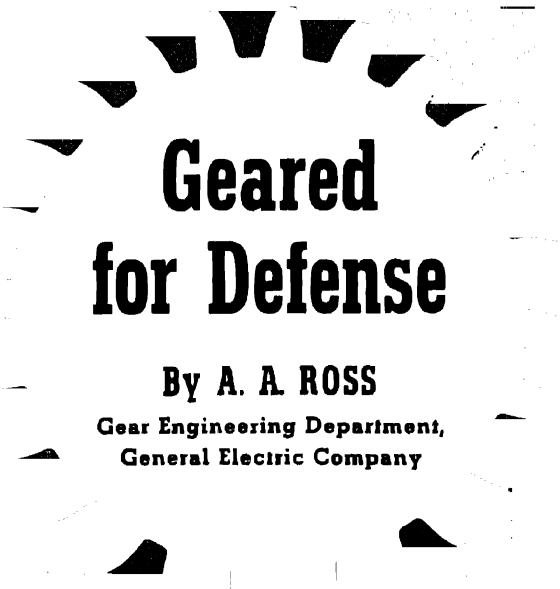
Rusted Sheets Repaired By Welding

By ARTHUR HAVENS

Rust will force the bottom of outside sheets on railway passenger cars outwards below the rivets. The sheets below the rivets can be removed by flame cutting, holding the torch parallel with the bottom edge of the sheet and ½ in. below the rivet line. Remove rust and slag and weld to the sheet a ⅛-in. band iron of the proper width. The weld can be ground flush and this area primed and painted, leaving no sign of the repair.

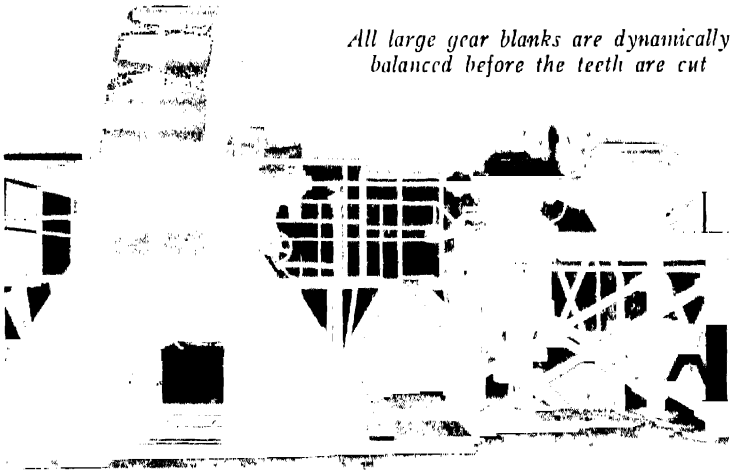
DEFENSE CONTRACTS

First complete list of current U. S. munitions and aircraft orders placed with private industry



By A. A. ROSS
Gear Engineering Department,
General Electric Company

GEARS FOR DEFENSE



All large gear blanks are dynamically balanced before the teeth are cut

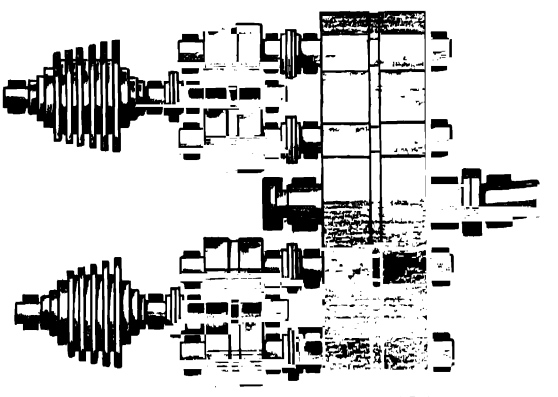
By A. A. ROSS
Gear Engineering Department, General Electric Company

BUILDING A TWO-OCEAN NAVY has turned the spotlight on every phase of ship-building. Not the least important is production of propulsion equipment. Most naval vessels now being built will be equipped with turbine-gear sets—turbines because they are the most efficient prime movers, gears because high turbine speeds must be reduced to slower speeds at which propellers operate most efficiently. For the manufacture of these gear reduction units, two shops at the General Electric Company plant in Lynn, Mass., are being expanded in a $3,000,000 program which will nearly double the company's reduction gear facilities.

Major parts of a gear reduction set include one or more pinions, a large "bull" gear, and casing. The bull gear is made of six pieces—a hub, four disks, and a tire. The hub is a steel casting, the disks are rolled plates, and the tire is a steel forging. All are welded together and strain annealed. The shaft is a single forging, ground to a slight taper to match that in the hub. The two are assembled with a carefully controlled press fit. The gear is then machined on its own journals, balanced, and is ready for hobbing.

Hobbing is done in a shop where temperature is maintained within five degrees of 72 F. Gear blanks are not brought into the shop unless their temperature is approximately 72 F., being cooled or heated in an anteroom if necessary. Once inside the shop, the blank is finish machined and set up on the hobbing machine table. Actual cutting time runs as high as 85 hr. Once a cut is begun the machine is not stopped until the cut is finished. Power supply is protected by an auxiliary plant. A rough and a finish cut are made on each of the two rows of helical teeth. Pin checks are made during rough machining. Finished





After being forced onto its shaft, a large gear blank has its outside diameter rough turned on this 20-ft. boring mill



About 85 hr. are required to hob the teeth in this 163-in. bull gear. Here teeth are being checked between roughing and finishing cuts

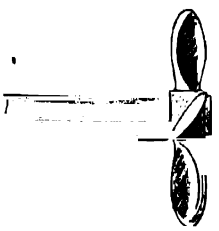


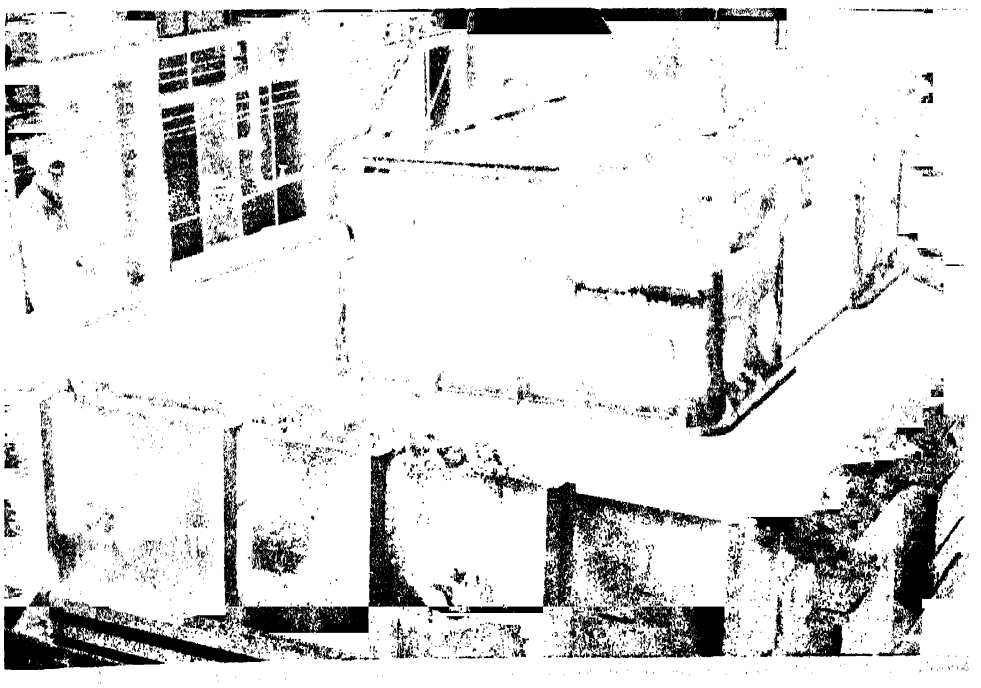
tooth spacing tolerance is 0.0003 in.

Nearly as important as the gears themselves are the casings, whose bearing housings must be extremely accurate. These housings are of cast steel, welded into the steel-plate casing. Machining on the bearing housings, done in a horizontal boring mill, is begun after the casing has been annealed and checked.

Operations up to this point require nearly eight months. Assembly and test require almost another two. Testing consists either of driving a generator through the unit or of using two units to drive each other, a motor supplying the losses.

Typical battleship gear reduction installations consist of two medium-speed shafts for each turbine, all four driving a huge bull gear on the propeller shaft





A fabricated gear reduction unit casing is lowered into an annealing furnace for stress removal. Lapped joints are steam-tight without gaskets

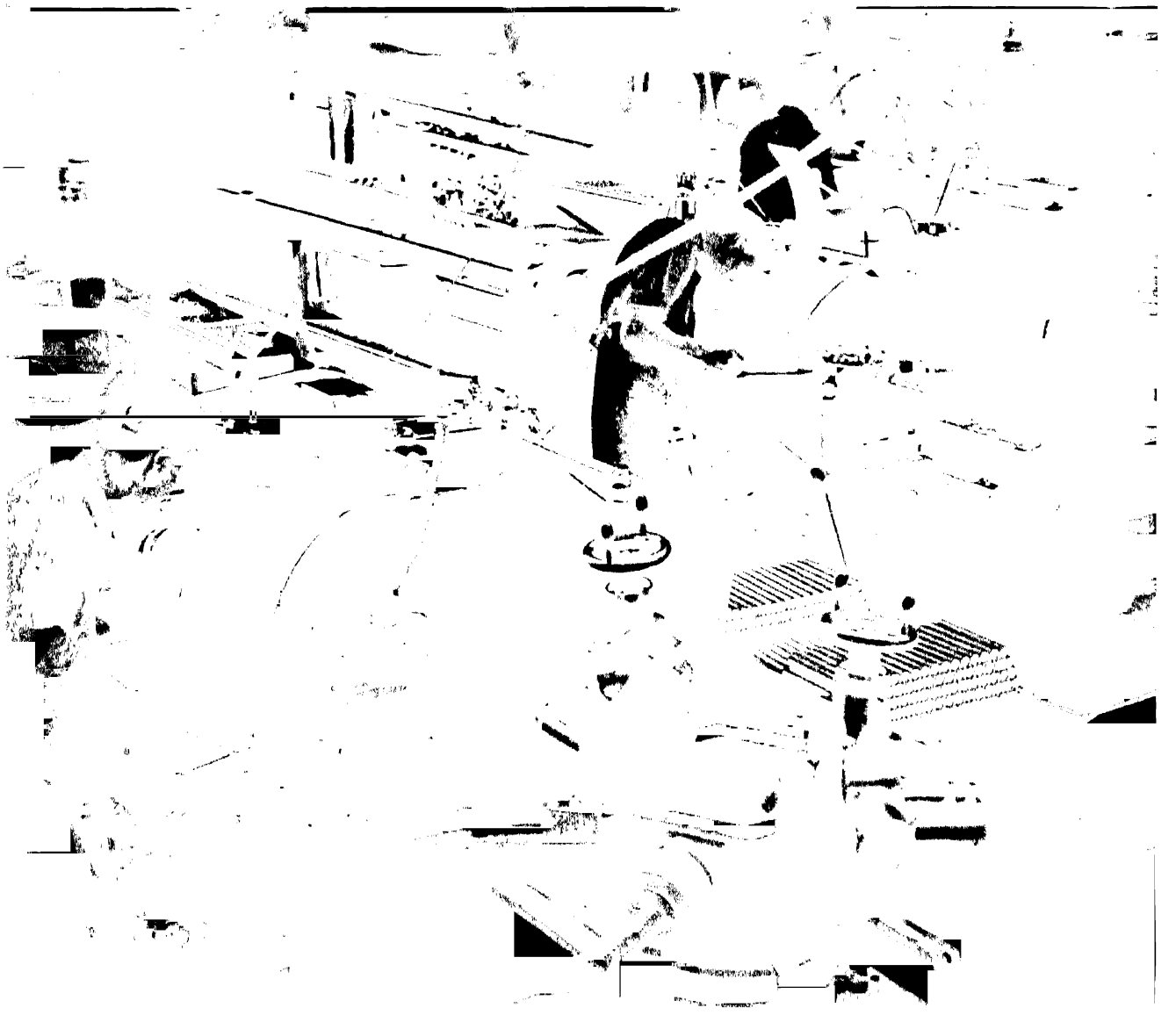
The Problem of AIRCRAFT

Decentralized production of aircraft parts is a vital step in boosting plane output. Here are some of the headaches and one company's cures for them

THOSE OF US who are producing parts for aircraft manufacturers are losing sleep figuring ways to get more work out of the same machines. We are torn between hawk-eyed Army inspectors and aircraft factory production pressure. We are running three full shifts, getting 22½ hours work per day out of each machine. But still we must maintain the highest possible precision.

Our plant was established on the Pacific Coast to manufacture air-hydraulic shock absorbing struts for airplane landing gears. We have steadily expanded operations until now we produce a complete line of hydraulic equipment in addition to the shock struts, most of it to specifications. Our work is highly specialized, and is vital to aircraft makers because in many cases we can make their hydraulic parts faster and more accurately than they can. By turning such work over to us, they free their own equipment for special machine work that is not so adaptable to farming out. They also get the benefit of our experience in this field, which includes

General purpose machines are used almost exclusively in an aircraft parts shop. Below is a battery of Warner & Swasey turret lathes at work on hydraulic cylinders. Tolerances are the usual aircraft tenths



PARTS

By R. J. WENGER

Shop Superintendent
Bendix Aircraft Limited



About three dozen separate precision parts make up the special hydraulic valve at the upper left. Cylinder in the foreground has 364 radial holes

producing similar equipment for other aircraft plants.

We used to produce a high percentage of parts in lots varying from 12 to 100. Now most of our orders are for complete units, in lots of 1,000 to 1,200 or more, averaging about 20 parts per unit. We have to inspect, assemble, and test all such units in our own plant and turn them over to the customer ready for installation and operation.

Our backlog is landing-gear shock absorbers and hydraulic actuating cylinders, but other hydraulic equipment which goes through our shop includes hand and motor driven pumps, various types of hydraulic valves, and similar assemblies.

Since hydraulic systems almost invariably involve pistons and cylinders, a large proportion of our machining is circular work, much of it done on turret lathes. About three-fourths of all parts are steel, although many pump and valve bodies are of aluminum or magnesium alloys. These alloys are sometimes finish machined from sand castings or die castings, but frequently are machined from solid stock.

Because we do work for a considerable number of customers our operation is comparable to that of a large job shop. The comparison is not entirely accurate, however, as we must maintain extensive engineering, inspection, final assembly, and test departments. This makes our work a great deal like that of a complete factory. Because we are working on a number of different orders for different customers, our production planning and control department must keep in close touch with all our customers and schedule all work through the shop to meet delivery dates.

To accomplish this our plant in three years has grown from a bare floor and a skeleton crew to a 27,000-sq. ft. plant employing some five hundred people, of whom more than half are in the shop itself. We have gone to a two-shift and then to a three-shift work schedule. Essentially we work three 8-hr. shifts. However, we take out a half-hour lunch period in such a way that the day and evening shifts each work a full 8 hr., while the graveyard shift works but 6½ hr. The actual shifts run: 8 a.m. to 4:30 p.m.; 4:30 p.m. to 1 a.m.; and 1 a.m. to 8 a.m. A maintenance crew is kept on during the day shift only. Because most of the equipment is quite new, this has proved adequate.

Since part of our work comes through our own engineering department, and part from engineering departments of our customers, who furnish us with their own working drawings, we have set up the production planning and control department to cover both types of orders equally. Working from purchase orders or blue prints, production planning breaks down each order into its component parts. Each part is set up on an individual parts chart showing material required, source

of material, estimated machine time, order of operations, tooling requirements, tooling follow-up, etc. A master machine-loading chart helps assign jobs. On this are listed the customer, job, part, description, quantity, hours estimated, when due out, delivery schedule, material, tools, and remarks.

Delivery requirements of the various customers determine the extent of runs. We try to run the maximum number of parts in all set-ups. But we are often forced to break down the operation into a number of periods, rushing through a portion of the work from time to time. In some cases we have to split up the job among various machines and use multiple set-ups. The wall chart, which shows machine loadings over a year ahead, guides



For speed and convenience final assembly and test departments are virtually one. Many hydraulic parts must stand a 4,500-lb. test pressure

our new equipment purchasing far enough in advance to forestall bottlenecks.

In an emergency we may be forced to subcontract some part of a job to another shop. In general, however, we keep ahead of schedule by having one machine of each classification unscheduled. This machine is used for "catch-up" jobs and is never idle. It can be shifted from job to job as delivery needs dictate, and the only loss of efficiency is in more frequent set-ups. A separate delivery requirement chart shows how we stand on any complete order by assemblies. While we are keeping charts to show machine loadings for a year ahead, we are also following through so closely on the heels of all jobs that we check the status of operations every 2 hours throughout the 24. Duplicate-move order cards accompany the job as it progresses from operation to operation. At each change the original stays with the work and the carbon copy is collected and posted in production control to show the new status.

Our shop arrangement is fairly conventional, with batteries of similar machine tools grouped together to simplify work flow. We now have fifteen Warner & Swasey turret lathes, eight engine lathes, five Van Norman mills, three Cincinnati mills, eight drill presses, three multiple spindle drill presses, one hone, one thread mill, two special cylinder boring lathes, a Lees-Bradner thread cutting mill and a Bakewell tapping machine, in addition to toolroom machines and miscellaneous other equipment. Shop operations are monitored by set-up men with each shift, working in the turret lathe, mill, and drill press departments. These men get job cards from production control and follow through from the tool crib to the job set up on the machine. A cross-indexed tool and fixture filing system in the tool crib greatly simplifies tool handling.

Much milling is on light alloy valve bodies, while most lathe work is on steel cylinders and pistons. For one type of four-way hydraulic valve we mill ten alloy valve bodies at a time, arranging all ten on the mill bed with special clamps. Many of our fixture problems, especially on lathe jobs, are particularly difficult because of flexibility of the parts and the high precision required. This is true of hydraulic cylinders, which are machined from chrome-molybdenum steel tubing in a special cylinder boring lathe we designed and built.

With hydraulic units we have many threaded holes for connections. Much of this work is done on a Bakewell hob tapper, which is very fast and extremely accurate. The Lees-Bradner thread cutting mill is also an important tool, as we have certain long shafts of our hydraulic strut assemblies which must be threaded with great precision.

Our final assembly department is unique because of the precision nature of the tests all units must pass following assembly. Assemblymen draw parts that have previously been individually inspected and frequently use special assembly jigs and wrenches. A final inspection crew works right in the assembly department to check and pass completed units. Elaborate test benches are used for final inspection of hydraulic units, test pressures running as high as 4,500 lb. per sq. in.

DEFENSE CONTRACTS

Placed from July 1, 1939, to September 14, 1940, and unfinished to that date

Source of Supply	*Amount*	*Delivery Date*
AIRPLANES		
(WAR)		
Aviation Mfg Corp, Wayne, Mich	$1,853,451	Indefinite
Beech Aircraft Corp, Wichita, Kansas	458,764	Indefinite
Bell Aircraft Corp, Buffalo, N Y	2,833,236	6/31/41
Boeing Aircraft, Seattle, Wash	8,102,892	6/20/41
Consolidated Aircraft Corp, San Diego, Calif	8,613,674	6/20/41
Curtiss-Wright Corp, (Curtiss Aeroplane Div) Buffalo, N Y	5,203,481	6/30/41
Douglas Aircraft Co, Inc, El Segundo, Calif	14,470,082	3/ 2/41
Fairchild Engine & Airplane Corp, (Fairchild Aircraft Div) Hagerstown, Md	1,038,300	3/31/41
	1,586,573	Indefinite
Glenn L Martin Co, Baltimore, Md	16,125,586	6/30/41
North American Aviation, Inc, Inglewood, Calif	11,847,652	Indefinite
	2,731,617	1/21/41
Seversky Aircraft Corp, Farmingdale, L I, N Y	3,547,255	Indefinite
(NAVY)		
Consolidated Aircraft Corp, San Diego, Calif	$20,016,599	Indefinite
Grumman Aircraft Engineering Corp, Bethpage, L I, N Y	1 786,860	11/13/40
Splarman Aircraft, Wichita, Kansas	3 779,628	9/15/41
United Aircraft Corp, East Hartford Conn	1,998,420	Indefinite
AIRPLANE PARTS ***(WAR)***		
Aviation Mfg Corp, Williamsport, Pa	$46,800	Indefinite
Beech Aircraft Corp, Wichita, Kansas	3,510,746	6/30/41
Bendix Aviation Corp, South Bend, Ind	56,284	Indefinite
	37,580	2/28/41
	110,200	Indefinite
McCauley Steel Propeller Co, Dayton, Ohio	82,350	Indefinite
Stell Products Engineering Co, Springfield, Ohio	30,690	11/30/40
(NAVY)		
Bendix Products Div, Bendix Aviation Corp, Bendix, N J	$120,000	6/30/41
Consolidated Aircraft Corp, San Diego, Calif	21,675	11/ 4/40
	22,286	12/ 6/40
	41,098	11/15/40
Curtiss-Wright Corp, Buffalo, N Y	41,315	11/12/40
Curtiss-Wright Corp, (Curtiss Propeller Div) Clifton, N J	134,822	4/11/42
Douglas Aircraft Co, Inc, Santa Monica, Calif	13,984	Indefinite
	11,564	9/10/41
Grumman Aircraft Eng Corp, Bethpage, L I, N Y	12,715	Indefinite
Hartzell Propeller Co, Piqua, Ohio	20,700	12/30/40
United Aircraft Corp, (Pratt & Whitney Aircraft Div) East Hartford, Conn	11,944	12 /5/40

Source of Supply	Amount	Delivery Date
United Aircraft Corp., (Hamilton Standard Propeller Div.) East Hartford, Conn	$90,000	6/30/41
	21,075	2/26/41
United Aircraft Corp., (Vought-Sikorsky Aircraft Div.) Stratford, Conn	59,249	11/ 7/40
	14,425	11/14/40
	16,446	12/ 2/40

BRAKE AND WHEEL ASSEMBLIES

(WAR)

Bendix Westinghouse Automotive Air Brake Co., Pittsburgh, Pa.	Indefinite	Indefinite
Hayes Industries, Inc., Jackson, Mich	$23,680	Indefinite
	Indefinite	8/31/41
	121,343	Indefinite
National Acme Co., Cleveland, Ohio	373,126	Indefinite
	74,720	12/26/40

CARTRIDGE CASES (WAR)

Albert & J. L. Anderson Mfg. Co., Boston, Mass.	$116,040	7/28/41
Bridgeport Brass Co., Bridgeport, Conn	716,800	Indefinite
	554,900	1/13/41
Chase Brass & Copper Co., Inc., Waterbury, Conn	1,353,505	Indefinite
	2,766,813	2/24/42
Chrysler Corp., Detroit, Mich	154,082	2/ 3/41
General Motors Corp., (Guide Lamp Div.) Detroit, Mich	149,362	1/23/41
Norris Stamping Co., Los Angeles, Calif	356,166	2/24/42
Scovill Mfg. Co., Inc., Waterbury, Conn	302,937	1/15/41

(NAVY)

Bridgeport Brass Co., Bridgeport, Conn	$1,187,860	1/10/42
Norris Stamping & Mfg. Co., Los Angeles, Calif	700,309	4/17/42
	253,728	6/12/42
Pollak Mfg. Co., Arlington, N. J	28,500	4/15/41

CARTRIDGE CUPS (WAR)

American Brass Co., Torrington, Conn	$20,840	2/20/40
	191,700	Indefinite

CARTRIDGE DISKS (WAR)

American Brass Co., Torrington, Conn	$110,950	Indefinite
	646,608	1/ 1/41
American Brass Co., Waterbury, Conn	80,190	Indefinite
Revere Copper & Brass, Inc., Baltimore, Md	1,017,433	1/ 1/41
	114,715	Indefinite

ELECTRICAL MACHINERY (WAR)

Federal Telegraph Co., Newark, N. J	*Radio transmitter*	$95,797	7/ 5/41
	Components for radio sets	244,101	1/10/41
General Electric Co., Schenectady, N. Y	*Sighting systems*	355,085	6/ 9/41
General Motors Corp., (Delco Appliance Div.) Rochester, N. Y	*Control equipment*	597,270	Indefinite

Source of Supply	Amount	Delivery Date
General Motors Corp., (Delco Appliance Div.) Rochester, N. Y. ... *Control equipment*	$236,534	4/22/41
Hammarlund Mfg. Co. Inc, New York, N. Y. ... *Radio receiver*	79,988	3/21/41
International Protector Corp., New York, N. Y. .. *Depth-sounding equipment*	142,500	Indefinite
Sperry Gyroscope Co. Inc., Brooklyn, N. Y. ... *Sound locators*	1,746,375	1/19/42

ENGINES

(WAR)

Continental Motors Corp., Muskegon, Mich.	$1,066,539	5/ 3/41
	123,879	11/16/40
Eclipse Aviation, Bendix, N. J.	226,259	1/ 8/41
Wright Aeronautical Corp., Paterson, N. J.	839,675	6/ 1/41

(NAVY)

Curtiss-Wright Corp., Buffalo, N. Y.	$15,523	12/23/40
Ranger Aircraft Engines, (Division of Fairchild Engine and Airplane Corp.) Farmingdale, L. I., N. Y.	5,489,308	7/ 1/42
Spartan Aircraft Co., Tulsa, Okla.	1,859,880	Indefinite
United Aircraft Corp., (Pratt & Whitney Aircraft Div.) East Hartford, Conn.	,952,766	Indefinite
	28,959	Indefinite
Wright Aeronautical Corp, Paterson, N. J.	19,183	Indefinite
	10,181	Indefinite
	375,009	12/ 1/40
	400,000	6/30/41

FORGINGS

(WAR)

Aluminum Co. of America, Edgewater, N. J.	$14,751	Indefinite
American Forge Div, American Brake Shoe & Foundry Co., Chicago, Ill.	624,000	2/19/41
	70,235	12/29/40
	160,500	Indefinite
American Locomotive Co, Schenectady, N. Y.	118,800	Indefinite
Baldwin Locomotive Works, Eddystone, Pa.	240,272	4/11/41
Bethlehem Steel Co., Bethlehem, Pa.	29,952	Indefinite
	121,728	Indefinite
	121,728	Indefinite
Chase Brass & Copper Co., Inc., Waterbury, Conn.	31,600	Indefinite
General Motors Corp., (Chevrolet Motor Div.) Detroit, Mich.	36,127	12/ 5/40
	67,320	12/30/40
Chrysler Corp., Detroit, Mich.	251,675	3/ 1/41
Colorado Fuel & Iron Corp., Denver, Colo.	177,098	5/ 7/41
Crucible Steel Co. of America, New York, N. Y.	47,125	Indefinite
Crucible Steel Co. of America, Harrison, N. J.	40,587	1/10/41
	65,000	6/ 5/41
A. Finkl & Sons Co., Chicago Ill.	14,175	Indefinite
Harvey Metal Corp., Chicago, Ill.	23,855	Indefinite
	90,930	Indefinite
	113,228	2/10/41
Kilby Steel Co., Anniston, Ala.	110,897	11/ 9/40
Midvale Co., Philadelphia, Pa.	101,080	Indefinite
	107,550	Indefinite
Mueller Brass Co., Port Huron, Mich.	22,000	Indefinite
	65,500	6/28/41
National Forge & Ordnance Co., Irvine, Pa.	39,685	4/ 1/41
	154,384	12/16/40
National Tube Co., McKeesport, Pa.	52,276	Indefinite

Source of Supply	Amount	Delivery Date
PECO MFG. CORP., Philadelphia, Pa	$75,000	Indefinite
	295,000	Indefinite
PENNSYLVANIA FORGE CORP., Philadelphia, Pa	44,767	3/ 1/41
	107,060	12/23/40
	76,250	Indefinite
PRESSED STEEL CAR CO. INC., McKees Rocks, Pa	119,832	12/15/40
PULLMAN-STANDARD CAR MFG. CO., Butler, Pa	81,590	1/15/41
SCOVILL MFG. CO., Waterbury, Conn	47,575	Indefinite
STRUTHERS-WELLS-TITUSVILLE CORP., Titusville, Pa	199,500	Indefinite
	207,575	Indefinite
	64,500	3/15/41
	65,783	3/14/41
	36,078	2/17/41
TAYLOR-WHARTON IRON & STEEL CO., Easton, Pa	129,770	11/ 2/40
TENNESSEE COAL IRON & RR. CO., Birmingham, Ala	123,739	3/ 8/41
(NAVY)		
ALLIS-CHALMERS MFG. CO., Milwaukee, Wis	$82,720	11/10/40
ALUMINUM CO. OF AMERICA, Cleveland, Ohio	20,690	1/ 1/41
	35,967	1/ 1/41
BETHLEHEM STEEL CO., Bethlehem, Pa	378,425	Indefinite
	210,000	1/23/41
	1,066,738	1/31/42
	97,162	8/ 1/41
	75,254	Indefinite
	180,120	Indefinite
	609,000	Indefinite
CAMDEN FORGE CO., Camden, N. J	134,877	11/ 1/41
CARNEGIE-ILLINOIS STEEL CORP., Munhall, Pa	213,775	2/20/41
CRUCIBLE STEEL CO. OF AMERICA, Harrison, N. J	468,458	8/31/41
	208,536	8/ 1/41
	882,300	1/ 1/42
	22,100	12/10/40
ERIE FORGE CO., Erie, Pa	60,721	6/ 1/41
	534,574	2/ 1/42
HEPPENSTALL CO., Pittsburgh, Pa	166,344	3/ 1/41
INTERNATIONAL NICKEL CO., INC., Huntington, W. Va	13,108	12/26/40
	92,208	Indefinite
	45,200	Indefinite
LADISH DROP FORGE CO., Cudahy, Wis	15,912	Indefinite
MIDVALE CO., Philadelphia, Pa	12,998	12/ 1/40
	2,282,820	2/25/42
	1,879,536	Indefinite
	22,900	3/ 9/41
	134,640	11/ 9/40
NATIONAL FORGE & ORDNANCE CO., Irvin, Pa	62,250	Indefinite
	504,309	11/30/41
	17,479	3/ 1/41
PENNSYLVANIA FORGE CORP., Philadelphia, Pa	103,217	2/20/41
	40,118	2/28/41
	88,730	2/26/41
STRUTHERS-WELLS-TITUSVILLE CORP., Titusville, Pa	87,520	1/26/41
	82,700	11/10/40

GUNS AND PARTS *(WAR)*

BAY TOOL AND MACHINE CO., Springfield, Mass	$34,136	3/ 5/41
C. H. COWDREY MACHINE WORKS, Fitchburg, Mass	174,208	9/20/41
CHARLES FISCHER SPRING CO., Brooklyn, N. Y	17,128	12/20/40

Source of Supply		Amount	Delivery Date
General Electric Co, Schenectady, N. Y.		$201,090	5/31/41
		552,834	11/30/41
Hadley Special Tool Co., Inc., Boston, Mass.		81,054	1/ 9/41
Harrington & Richardson Arms Co., Worcester, Mass.		193,497	8/ 9/41
Midvale Co., Philadelphia, Pa.		428,736	Indefinite
National Pneumatic Co. Inc., Rahway, N. J.		1,412,227	11/15/41
Saginaw Steering Div., General Motors Corp., Saginaw, Mich.		726,004	6/15/41
Singer Mfg. Co., Elizabeth, N. J.		278,875	1/13/42
United Shoe Machinery Corp., Boston, Mass.		1,316,485	2/10/42
York Safe & Lock Co., York, Pa.		719,198	Indefinite

IRON, STEEL, BRASS, ETC. PRODUCTS

(WAR)

American Brass Co., Kenosha, Wis.	*Metal tubing*	$32,966	Indefinite
American Brass Co., Waterbury, Conn.	*Copper rotating bands*	21,059	Indefinite
American Bridge Co., Ambridge, Pa.	*Gun emplacements*	11,592	11/30/40
American Car & Foundry Co., Berwick, Pa.	*Pontoon bridge equipment*	247,390	Indefinite
	Parts	29,580	11/10/40
Atlas Powder Co., Wilmington, Del.	*Starter cartridges*	20,400	Indefinite
Baldwin Locomotive Works, Philadelphia, Pa.	*Gun mounts*	1,114,454	11/10/40
Bethlehem Steel Co., Bethlehem, Pa.	*Demolition bombs*	2,545,095	6/30/41
Bridgeport Thermostat Co. Inc., Bridgeport, Conn.	*Practice bomb*	188,167	5/26/41
Builders Iron Foundry, Providence, R. I.	*Telescope mounts*	105,509	6/16/41
Burgess-Norton Mfg. Co., Geneva, N. Y.	*Bodies*	37,632	12/16/40
Chrysler Corp., Detroit, Mich.	*Bomb fuses*	97,079	1/26/41
Consolidated Steel Corp., Ltd., Los Angeles, Calif.	*Demolition bombs*	109,626	1/29/41
Corbin Screw Corp., New Britain, Conn.	*Bomb fuses*	29,340	2/28/41
Crucible Steel Co. of America, New York, N. Y.	*Shot*	113,236	7/ 5/41
Diebold Safe & Lock Co., Canton, Ohio.	*Parts*	27,580	1/ 1/41
Henry Disston & Sons, Inc., Philadelphia, Pa.	*Armor plate*	1,424,089	4/ 3/41
		68,006	7/ 1/41
Doehler Die Casting Co., Pottstown, Pa.	*Die castings*	50,087	1/ 7/41
Enterprise Tool & Gear Corp., Detroit, Mich.	*Gears*	52,012	2/28/41
A. B. Farquhar Co., Ltd., York, Pa.	*Mortars & Mounts*	128,459	Indefinite
Federal Screw Works, Chelsea, Mich.	*Fuse units*	32,622	4/17/41
	Components for booster	59,795	12/30/40
Charles Fischer Spring Co., Brooklyn, N. Y.	*Parts for rifles*	17,128	12/20/40
Fort Pitt Bedding Co., Pittsburgh, Pa.	*Metallic belt links*	419,200	12/31/41
Fulton Sylphon Co., Knoxville, Tenn.	*Fuses*	101,991	7/26/41
General Motors Corp., Cleveland, Ohio.	*Propelling machinery*	2,317,857	Indefinite
Grayson Heat Control Ltd, Lynwood, Calif.	*Bomb fuses*	98,092	5/19/41
H. Grinton Co., Philadelphia, Pa.	*Telescope mounts*	17,961	12/ 7/40
James Cunningham Son & Co., Rochester, N.Y.	*Carriage assemblies*	62,856	12/22/40
Karp Metal Products Co., Inc., Brooklyn, N. Y.	*Radio cabinet assemblies*	20,461	2/26/41
Lukenweld, Inc., Coatesville, Pa.	*Base rings*	39,504	2/10/41
Lundquist Tool & Mfg. Co., Worcester, Mass.	*Telescope mounts*	105,710	2/25/41
		39,240	11/ 3/41
Martin-Parry Corp., York, Pa.	*Fin assemblies*	10,232	Indefinite
Mattatuck Mfg. Co., Waterbury, Conn.	*Battery cups*	12,380	Indefinite
Mergenthaler Linotype Co., Brooklyn, N. Y.	*Telescope mounts*	545,591	1/14/42
	Aiming circles	128,953	10/26/41

Source of Supply		Amount	Delivery Date
National Pneumatic Co., Rahway, N. J.	*Mortars and mounts*	$10,312	6/ 1/41
Oliver Iron & Steel Corp., Pittsburgh, Pa.	*Lifting plugs*	16,727	12/31/40
Parker Appliance Co., Cleveland, Ohio	*Adapters*	10,987	Indefinite
Peco Mfg. Corp., Philadelphia, Pa.	*Nose plugs*	23,287	Indefinite
Philco Corp., Philadelphia, Pa.	*Fuses*	133,485	8/29/41
Remington Arms Co., Inc., Bridgeport, Conn.	*Ammunition*	655,774	12/31/40
Remington Arms Co. Inc., Bridgeport, Conn.	*Percussion assemblies*	55,000	3/ 1/41
Revere Copper & Brass, Inc., Rome, N. Y.	*Battery cups*	15,750	Indefinite
Revere Copper & Brass, Inc., Baltimore, Md.	*Hard bands*	20,290	Indefinite
Russakov Can Co., Chicago, Ill.	*Practice bombs*	117,300	1/26/41
Scovill Mfg. Co., Waterbury, Conn.	*Primer bodies*	232,500	Indefinite
	Primer bodies	43,500	Indefinite
Seth Thomas Clocks, Thomaston, Conn.	*Fuse parts*	36,825	Indefinite
Standard Pressed Steel Co., Jenkintown, Pa.	*Heads for primer*	65,730	Indefinite
	Bullet cores	304,800	6/22/41
	Components for primers	42,251	Indefinite
Standard Steel Works, North Kansas City, Mo.	*Box assemblies*	19,468	Indefinite
Struthers-Wells-Titusville Corp., Titusville, Pa.	*Breech rings*	23,166	12 /5/40
Thompson Products, Inc., Detroit, Mich.	*Fuse adapters*	121,282	Indefinite
Tophams, Inc., Washington, D. C.	*Pontoon bridge equipment*	41,128	Indefinite
Treadgear Co., Richmond, Va.	*Practice projectiles*	99,855	Indefinite
Variety Aircraft Corp., Dayton, Ohio	*Stand assemblies*	177,500	10/28/41
Vega Airplane Co., Burbank, Calif.	*Trainer assemblies*	63,550	1/24/41
Waltham Watch Co., Waltham, Mass.	*Fuse parts*	16,619	Indefinite
Westclox, Div. of General Time Instruments Corp., La Salle, Ill.	*Fuse parts*	185,299	3/13/41
	Fuse parts	46,365	Indefinite
Western Cartridge Co., East Alton, Ill.	*Cartridge*	454,798	5/ 1/42
Wright Machine Co., Worcester, Mass.	*Body plugs*	10,399	Indefinite
York Safe & Lock Co., York, Pa.	*Fuse setters*	122,132	7/14/41
	Gun carriages	794,300	5/ 1/41
		829,500	5/30/41
	Cradle assemblies	57,050	11/ 2/40
(NAVY)			
William R. Bootz, Evansville, Ind.	*Practice bombs*	$14,012	4/ 2/41
Camden Forge Co., Camden, N. J.	*Training circle racks*	137,500	6/ 1/41
Carnegie-Illinois Steel Corp., Pittsburg, Pa.	*Steel plates*	496,620	Indefinite
Carnegie-Illinois Steel Corp., Munhall, Pa.	*Steel plates*	4,702,240	5/31/41
Doehler Die Castings Co., Pottstown, Pa.	*Miniature bombs*	15,100	12/ 7/40
	Practice bombs	19,140	12/27/40
Dravo Corp., Pittsburgh, Pa.	*Caisson*	574,800	Indefinite
Edwards Mfg. Co., Cincinnati, Ohio	*Practice bombs*	79,166	3/ 9/41
	Practice bombs	53,100	1/13/41
Fairbanks Morse & Co., Beloit, Wis.	*Propelling machinery*	1,435,360	Indefinite
General Motors Corp., (Cleveland Diesel Engine Div.) Cleveland, Ohio	*Propelling machinery*	1,358,159	Indefinite
Howard Foundry Co., Chicago, Ill.	*Protecting cap assemblies*	92,097	4/15/42
Lukenweld Inc., Coatesville, Pa.	*Carriage slides*	60,948	Indefinite
McKiernan-Terry Corp., Harrison, N. J.	*Winches*	16,448	11/27/40
Midvale Co., Philadelphia, Pa.	*Slides*	320,200	Indefinite
Mitchell Metal Products, Inc., Cleveland, Ohio	*Extractors for cartridge cases*	28,350	4/15/42
National Forge & Ordnance Co., Irvine, Pa.	*Propeller shafts*	70,275	11/ 6/40
Norris Stamping & Mfg. Co., Los Angeles, Calif.	*Ammunition boxes*	335,524	10/ 1/42
Pollak Mfg. Co., Arlington, N. J.	*Ammunition boxes*	16,500	Indefinite
	Aluminum containers	28,500	4/15/41

Source of Supply		Amount	Delivery Date
Pressed Steel Tank Co., West Allis, Wis.	*Afterbody shells*	$24,876	Indefinite
Remington Arms Co., Inc., Bridgeport, Conn.	*Cartridges*	44,120	Indefinite
Russakov Die Castings Co., Chicago, Ill.	*Practice bombs*	71,400	2/20/41
Shenango-Penn Mold Co., Dover, Ohio.	*Propeller sleeves*	15,372	11/21/40
Stewart Warner Corp., Chicago, Ill.	*Steel bodies*	33,930	Indefinite
Struthers-Wells-Titusville Corp., Titusville, Pa.	*Crankshafts*	16,950	11/16/40
Treadwell Engineering Co., Easton Pa.	*Gun saddles*	36,850	Indefinite
Widan Metal Goods Co., Garwood, N. J.	*Machine gun mounts*	59,197	12/9/40
York Safe & Lock Co., York, Pa.	*Gun mounts*	59,846	Indefinite

NAVAL VESSELS (NAVY)

Bath Iron Works Corp., Bath, Maine.	*Destroyer*	$4,898,000	12/12/41
		4,813,000	6/15/41
		4,813,000	8/15/41
		4,898,000	2/12/42
Bethlehem Steel Co., Quincy, Mass.	*Light cruiser*	11,695,000	7/25/42
		11,695,000	9/25/42
	Aircraft carrier	Indefinite	12/2/40
Electric Boat Co., Groton, Conn.	*Submarine*	2,957,000	2/12/42
		2,957,000	2/27/42
		2,957,000	5/12/42
		2,937,000	7/15/41
		2,937,000	9/15/41
		2,937,000	11/15/41
		2,797,000	5/15/41
Federal Shipbuilding & Dry Dock Co., Kearny, N. J.	*Destro*	4,895,000	6/15/41
		4,895,000	8/15/41
		5,277,000	12/12/41
		5,277,000	2/12/42
	Light cruiser	12,226,000	4/25/42
	Light cruiser	12,226,000	6/25/42
Higgins Industries, Inc., New Orleans, La.	*Boats*	856,406	12/30/40
	Surf boats	57,896	12/31/40
Robert Jacob, Inc., City Island, N. Y.	*Harbor tugs*	417,690	1/30/41
Livingston Shipbuilding Co., Orange, Texas.	*Surf landing boats*	118,824	11/20/40
Luders Marine Constr. Co., Stamford, Conn.	*Harbor tugs*	397,000	7/1/41
Newport News Shipbuilding & Drydock Co., Newport News, Va.	*Aircraft carrier*	21,800,000	2/10/42
New York Shipbuilding Corp., Camden, N. J.	*Light cruiser*	17,990,000	3/23/43
		17,990,000	6/23/43
	Cruisers	17,580,000	6/27/43
		17,580,000	9/27/43
	Repair ship	13,997,000	4/1/42

ON-CARRIAGE PARTS (WAR)

Eclipse Aviation Div., Bendix Aviation Corp., Bendix, N. J.		$267,491	Indefinite
		14,860	Indefinite
		19,500	7/20/41
		43,331	11/6/41

PUMP ASSEMBLIES (WAR)

Pump Engineering Service Corp., Cleveland, Ohio.		$23,400	Indefinite
		26,605	Indefinite
		36,066	12/23/40

Source of Supply	Amount	Delivery Date

SHELLS (WAR)

American Cork Co., Lancaster, Pa.	$81,311	4/26/41
Babcock Printing Press Corp., New London, Conn.	183,131	3/27/41
J. C. Beaird Corp., Shreveport, La.	108,919	6/19/41
Bethlehem Steel Co., Bethlehem, Pa.	26,344	12/14/40
Budd Wheel Co., Detroit, Mich.	589,446	4/30/41
	193,257	1/13/41
	375,996	1/15/41
	259,266	3/17/41
	447,037	2/10/41
	206,558	1/ 6/41
	1,737,000	4/28/41
	1,198,393	2/ 8/42
Chevrolet Motor Div., General Motors Corp., Detroit, Mich.	100,850	6/ 8/41
Chrysler Corp., Detroit, Mich.	110,616	3/ 9/41
Continental Gin Co., Birmingham, Ala.	72,521	5/12/41
Darling Valve & Mfg. Co., Williamsport, Pa.	58,902	3/17/41
General Iron Works Co., Denver, Colo.	115,455	9/ 1/41
General Railway Signal Co., Rochester, N. Y.	112,560	1/ 6/41
Key Co., East St. Louis, Ill.	164,205	3/ 1/41
Kingston Products Corp., Kokomo, Ind.	45,062	12/18/40
Line Material Co., Milwaukee, Wis.	104,432	8/ 3/41
Minneapolis-Moline Power Implement Co., Minneapolis, Minn.	141,142	6/21/41
Motor Wheel Corp., Lansing, Mich.	67,108	1/ 2/41
Murray Co., Atlanta, Ga.	91,206	11/13/41
New York Air Brake Co., Watertown, N. Y.	79,552	3/ 3/41
W. C. Norris Mfg. Co., Inc., Tulsa, Okla.	76,689	10/10/41
Omaha Steel Works, Omaha, Neb.	161,658	11/30/41
Pullman Standard Car Mfg. Co., Butler, Pa.	171,997	3/ 5/41
Stockham Pipe Fittings Co., Birmingham, Ala.	69,937	5/ 8/41
U. S. Machine Corp., Lebanon, Ind.	35,155	12/ 3/40
Henry Vogt Machine Co., Louisville, Ky.	185,165	8/ 4/41
Wheland Co., Chattanooga, Tenn.	66,758	1/ 9/41

TRACTOR-TRUCKS (WAR)

Allis Chalmers Mfg. Co., Milwaukee, Wis.	$512,346	4/17/41
	684,063	12/20/41
Auto Sales & Service Co., Ardmore, Pa.	393,652	4/ 8/41
Biederman Motors Corp., Cincinnati, Ohio.	124,582	11/29/40
Caterpillar Tractor Co., Peoria, Ill.	137,456	11/22/40
International Harvester Co., Chicago, Ill.	2,272,500	4/17/41

TRUCKS (WAR)

American Bantam Car Co., Butler, Pa.	$173,070	Indefinite
Corbitt Co., Henderson, N. C.	1,396,664	1/ 4/41
	101,526	Indefinite
Diamond T Motor Car Co., Chicago, Ill.	3,249,414	12/28/40
Fargo Motor Corp., Detroit, Mich.	11,650,985	1/25/41
	929,265	12/26/40
General Motors Corp., (Chevrolet Div.) Detroit, Mich.	549,213	Indefinite
Heil Co., Milwaukee, Wis.	117,515	Indefinite

Source of Supply	Amount	Delivery Date
Marmon-Herrington Co. Inc., Indianapolis, Ind.	$27,060	11/10/40
Pressed Steel Car Co. Inc., Pittsburgh, Pa.	16,344	12/26/40
Yellow Truck & Coach Mfg. Co., (General Motors Truck & Coach Div.) Pontiac, Mich.	2,510,357	1/20/41
	12,917,671	12/31/40
	402,790	Indefinite

(NAVY)

International Harvester Co., Inc., Fort Wayne, Ind.	$33,460	11/30/40
Marmon-Herrington Co., Inc., Indianapolis, Ind.	75,400	12/23/40
	90,464	12/13/40

OTHER TRANSPORTATION EQUIPMENT

(WAR)

American Car & Foundry Co, New York, N. Y. — *Light tanks*	$6,055,251	1/13/41
	11,496,951	4/17/41
Baldwin Locomotive Works, Eddystone, Pa. — *Wheel & axle assemblies*	13,140	Indefinite
Barnard Aviation Equip. Co. Inc., Wilkes-Barre, Pa. — *Cannon mount assemblies*	17,582	2/20/41
Bendix Aviation Corp., (Eclipse Aviation Div.) Bendix, N. J. — *Starter assemblies*	191,836	Indefinite
Parts for generators and starters	25,148	Indefinite
Starters	14,220	Indefinite
Edward G. Budd Mfg. Co., Philadelphia, Pa. — *Wing panels*	43,204	Indefinite
Century Boat Co. of Manistee, Manistee, Mich. — *Boats*	114,359	Indefinite
Douglas Aircraft Co., Inc., Santa Monica, Calif. — *Gun sight assemblies*	115,000	Indefinite
Federal Motor Truck Co, Detroit, Mich. — *Truck parts*	Indefinite	Indefinite
Heil Co., Milwaukee, Wis. — *Trailers*	832,330	Indefinite
Indian Motor Cycle Co., Springfield, Mass. — *Parts for motorcycles*	Indefinite	Indefinite
Link Aviation Devices, Inc., Binghamton, N.Y. — *Trainer assemblies*	509,182	Indefinite
Mack Mfg. Corp., Allentown, Pa. — *Transportation auxiliaries*	82,860	Indefinite
Standard Steel Works, North Kansas City, Mo. — *Adapters*	18,750	1/15/41
Steel Products Engr. Co., Springfield, Ohio — *Engine adapter cylinders*	19,750	Indefinite
Trailer Co. of America, Cincinnati, Ohio — *Trailers*	40,780	Indefinite
White Motor Co., Cleveland, Ohio — *Scout cars*	5,412,936	6/23/41

(NAVY)

Bendix Products Div., Bendix Aviation Corp., South Bend Ind. — *Wheels and axles*	$55,629	Indefinite
Landing gears	17,757	Indefinite
Carburetor assemblies	25,537	Indefinite
J. Edward Bolich, Philadelphia, Pa. — *Brakes*	12,070	11/23/40
H. Addison Bowie, Washington, D. C. — *Motorcycle parts*	34,096	2/ 5/41
Charles Bruning Co. Inc., Pasadena, Calif. — *Aircraft protractors*	11,850	Indefinite
Dorsey Bros., Elba, Fla. — *Trailers*	14,510	12/ 9/40
Eclipse Aircraft Div., Bendix, N. J. — *Starters*	43,614	Indefinite
General Motors Corp., Cleveland, Ohio — *Propelling machinery*	2,056,250	Indefinite
Pioneer Instrument Co. Inc., Bendix, N. J. — *Altimeter parts*	103,635	Indefinite
Pump Engineering Serv. Corp., Cleveland, Ohio — *Pumps*	11,339	Indefinite
Steel Products Engr. Co., Springfield, Ohio — *Propeller hubs*	16,330	Indefinite
United Aircraft Corp., (Pratt & Whitney Aircraft Div.) East Hartford, Conn. — *Aircraft magnetos*	24,725	11/26/40
Wright Aeronautical Corp., Paterson, N. J. — *Crankshaft assemblies*	36,514	Indefinite

MISCELLANEOUS EQUIPMENT (WAR)

Source of Supply		Amount	Delivery Date
Bausch & Lomb Optical Co., Rochester, N. Y.	*Telescopic sights*	$109,322	5/19/41
	Octants	112,350	5/21/41
	Spotting instruments	45,926	1/24/42
Bendix Aviation Corp., Pioneer Instrument Div., Bendix, N. J.	*Driftmeter assemblies*	50,000	8/ 2/41
Cambridge Instrument Co., Inc., New York	*Indicator assemblies*	11,375	Indefinite
Cummings Machine Works, Boston, Mass.	*Range quadrant*	51,587	5/ 6/41
Eastman Kodak Co., Rochester, N. Y.	*Aiming circles*	104,411	4/ 6/41
Fairchild Aviation Corp., Jamaica, N. Y.	*Aircraft cameras*	468,757	7/28/41
	Aircraft cameras	10,626	Indefinite
	Aircraft cameras	509,941	2/20/41
General Electric Co., Schenectady, N. Y.	*Sighting systems*	51,794	7/ 2/41
W. & L. E. Gurley, Troy, N. Y.	*Azimuth instruments*	255,312	Indefinite
Keuffel & Esser Co., Hoboken, N. J.	*Height finders*	887,716	12/31/42
	Height finders	718,727	Indefinite
	Height finders	542,082	1/ 1/42
Kollsman Instrument Co., Inc., Elmhurst, N. Y.	*Air speed indicator assemblies*	32,830	Indefinite
	Indicators	39,771	Indefinite
	Altimeter assemblies	83,350	Indefinite
W. L. Maxon Corp., New York, N. Y.	*Quadrants*	105,589	10/25/41
Mergenthaler Linotype Co., Brooklyn, N. Y.	*Telescopes*	99,557	7/16/41
	Range quadrants	797,664	1/14/42
Minneapolis-Honeywell Regulator Co., Minneapolis	*Sights*	45,309	6/ 1/41
Pioneer Instrument Co. Inc., Bendix, N. J.	*Indicator assemblies*	114,400	Indefinite
	Driftmeter assemblies	573,990	6/20/41
Precision Mfg. Co., Philadelphia, Pa.	*Telescope mounts*	68,120	3/31/41
Safety Car Heating & Lighting Co., New York, N. Y.	*Sighting equipment*	129,938	6/ 2/41
Spencer Lens Co., Buffalo, N. Y.	*Projector and accessories*	31,299	Indefinite
	Azimuth instrument	43,838	2/24/41
Sperry Gyroscope Co., Inc., Brooklyn, N. Y.	*Sound locators*	2,154,260	1/31/42
	Gyroscope test apparatus	14,400	1/20/41
	Parts for Searchlight	18,279	1/14/41
	Theodolite	17,400	Indefinite
Tuthill Pump Co., Chicago, Ill.	*Quadrants*	41,513	12/16/40
Variety Aircraft Corp., Dayton, Ohio	*Telorus assemblies*	15,566	1/18/41
David White Co., Milwaukee, Wis.	*Theodolite*	39,650	1/ 9/41

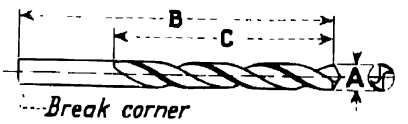
(NAVY)

Keuffel & Esser Co., Hoboken, N. J.	*Theodolites*	$14,960	5/28/41
Kollsman Instrument Co. Inc., Elmhurst, N. Y.	*Aircraft compasses*	12,831	Indefinite
	Aircraft altimeters	96,152	Indefinite
	Air speed indicators	19,950	Indefinite
	Tachometer generators	38,972	1/13/41
Bendix Aviation Corp., Bendix, Pioneer Instrument Div., N. J.	*Aircraft accelerometers*	Indefinite	Indefinite
	Aircraft octants	227,075	Indefinite
	Turn and tank indicators	41,580	Indefinite
	Aircraft indicators	29,767	Indefinite
	Generators	46,900	12/28/40
Spencer Lens Co., Buffalo, N. Y.	*Telescopic alidades*	40,596	7/22/41
Spencer Lens Optical Co., Rochester, N. Y.	*Telescopic alidades*	58,220	Indefinite
Sperry Gyroscope Co. Inc., Brooklyn, N. Y.	*Gyros*	201,600	Indefinite
	Gyros	216,000	Indefinite
	Automatic pilot	950,136	Indefinite

Straight-Shank Drill Standards

AMERICAN STANDARDS ASSOCIATION has approved standards for straight-shank twist drills. It is intended to establish (1) American standard practice for terminology and definitions of such drills, (2) the preferred diameters of straight-shank drills varying in diameter from 0.0156 to 0.500 in., and (3) the corresponding drill length and flute lengths. The standard was sponsored by the A.S.M.E., S.A.E., and the National Machine Tool Builders Association.

The standard covers a sufficient number of drill diameters to provide suitable percentages of screw thread depth in tapped holes for different conditions pertaining to each thread size in the American Standard Course and the American Standard Fine Screw Thread Series within the range of the drills specified.



Dimensions for 0.0156-0.2460-in. diameter drills

Diameter of Drill A	Over-All Length B	Flute Length C
0.0156	7/8	3/16
0.0180	15/16	3/16
0.0200	1	1/4
0.0225	1 1/8	1/4
0.0240	1 3/16	5/16
0.0260	1 5/16	7/16
0.0280	1 5/16	7/16
0.0295	1 3/8	7/16
0.0312	1 1/2	9/16
0.0330	1 1/2	5/8
0.0350	1 1/2	5/8
0.0370	1 1/2	5/8
0.0390	1 1/2	5/8
0.0410	1 9/16	11/16
0.0430	1 11/16	3/4
0.0453	1 11/16	3/4
0.0469	1 3/4	3/4
0.0492	1 11/16	3/4
0.0512	1 3/4	3/4
0.0531	1 3/4	7/8
0.0550	1 13/16	7/8
0.0571	1 13/16	7/8
0.0591	1 13/16	7/8
0.0610	1 13/16	7/8
0.0625	2 1/2	1 1/4
0.0630	1 7/8	7/8
0.0650	1 7/8	15/16
0.0670	1 15/16	15/16
0.0700	1 15/16	15/16
0.0730	2	15/16
0.0760	2 1/16	1 1/16
0.0781	2 5/8	1 3/8
0.0810	2 1/8	1 1/8
0.0827	2 3/16	1 3/16
0.0860	2 3/16	1 1/8
0.0890	2 1/4	1 1/8
0.0906	2 1/4	1 1/4
0.0937	2 3/4	1 1/2
0.0960	2 5/16	1 1/4
0.0995	2 7/10	1 3/8
0.1024	2 7/16	1 7/16
0.1040	2 1/2	1 3/8
0.1065	2 9/16	1 1/2
0.1094	2 7/8	1 5/8
0.1130	2 11/16	1 5/8
0.1160	2 11/16	1 5/8
0.1200	2 3/4	1 5/8
0.1220	2 3/4	1 5/8

Diameter of Drill A	Regular Series		Long Series	
	Over-All Length B	Flute Length C	Over-All Length B	Flute Length C
0.1250	3	1 3/4	5 1/8	3
0.1285	2 13/16	1 3/4	....	....
0.1299	2 13/16	1 11/16	....	....
0.1339	2 13/16	1 11/16	....	....
0.1360	2 13/16	1 3/4	....	....
0.1378	2 13/16	1 11/16	....	....
0.1406	3 1/8	1 7/8	5 3/8	3 1/4
0.1440	2 15/16	1 7/8	....	....
0.1470	2 15/16	1 7/8	....	....
0.1520	3 1/16	1 7/8	....	....
0.1562	3 1/4	2	5 3/8	3 1/4
0.1610	3 3/16	2	....	....
0.1660	3 1/4	2	....	....
0.1695	3 5/16	2 1/8	....	....
0.1719	3 3/8	2 1/8	5 3/4	3 1/2
0.1730	3 5/16	2 1/8	....	....
0.1770	3 3/8	2 1/8	....	....
0.1800	3 7/16	2 1/4	....	....
0.1850	3 1/2	2 1/4	....	....
0.1875	3 1/2	2 1/4	5 3/4	3 1/2
0.1910	3 9/16	2 1/4	....	....
0.1935	3 5/8	2 3/8	....	....
0.1960	3 11/16	2 3/8	....	....
0.1990	3 11/16	2 3/8	....	....
0.2031	3 5/8	2 3/8	6	3 5/8
0.2090	3 7/8	2 1/2	....	....
0.2130	3 15/16	2 5/8	....	....
0.2187	3 3/4	2 1/2	6	3 5/8
0.2244	3 7/8	2 11/16	....	....
0.2280	4	2 3/4	....	....
0.2344	3 7/8	2 5/8	6 1/8	3 3/4
0.2402	3 7/8	2 11/16	....	....
0.2460	4	2 3/4	....	....
....	....	....	....	....
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Terminology and Definitions

Drill—An end-cutting tool which consists of a shank, neck, body, and point. The neck is omitted on some sizes.

Body—That portion extending from the shank or neck to the outer corners of the cutting lip.

Shank—That part of the drill by which it is held and driven.

Neck—The diametrically relieved portion between body and shank.

Tang—The flat end of the shank, intended to fit into a driving slot in the drill holder or socket.

Point—The cutting end of a drill, made up of the ends of the land and the web forming the lip, usually, it is roughly conical in form.

Over-All Length—The length from the shank end to the outer corners of the cutting lips. It does not include the conical cutting point.

Flute Length—The distance from the outer corners of the cutting lips to the extreme back end of the flute.

Flute—The helical or straight grooves cut or formed in the body of the drill to provide cutting edges, to permit removal of chips, and to allow cutting fluid to reach the edges.

Land—The periphery of that portion of the drill body not cut away from the flute.

Margin—That portion of the land which is not cut away to provide clearance. The margin forms the full diameter of the drill.

Body Diameter Clearance—That portion of the land that has been cut away so it will not rub against the walls of the holes. Sometimes called the "land clearance." Its purpose is to reduce friction.

Clearance Diameter—The diameter of the relieved portion of the drill.

Web—The central portion of the body that joins the land. The extreme end of web forms the chisel edge.

Web Thickness—The minimum thickness of the web at the point.

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AVAILABLE THROUGH ALL LEADING SUPPLY HOUSES

Straight-Shank Drill Standards

unless another location is indicated.

Web Thinning—The operation of reducing the web thickness at the point to reduce drilling thrust.

Chisel Edge—The edge at end of web that connects cutting edges.

Lips—The cutting edges of the drill extending from the chisel edge to the periphery.

Helix Angle—The angle which the leading edge of the land makes with the axis of the drill. The helix angle is identical with the rake angle of the cutting edges at the periphery of the drill. A straight-flute drill would have no helix angle.

Rake Angle (*In Relation to Work*)—The angle between the leading edge of the land and the axis at the drill point.

Point Angle—The angle included between the lips.

Lip Relief Angle—The angle measured between a tangent at the surface back of the cutting edge at the periphery and a line at right angles to the axis of the drill.

Chisel-Edge Angle (*Center Angle*)—The angle included between the chisel edge and the cutting edge as seen from the end of the drill.

Back Taper (*Longitudinal Relief*)—Drills are usually made slightly smaller in diameter at the shank end than at the point; this is known as back taper.

Axis—The longitudinal center line through the drill.

Dimensions for 0.2500–0.500 in. diameter drills

Diameter of Drill	New Lengths				Conventional Lengths			
	Regular Series		Long Series		Jobber's or Short Series		Taper or Long Series	
	Over-All Length	Flute Length	Over-All Length	Flute Length	Over-All Length	Flute Length	Over-All Length	Flute Length
A	B	C	B	C	B	C	B	C
0.2500	4 1/2	3 1/8	6 1/2	4 5/16	4	2 3/4	6 1/8	4
0.2520	4 1/2	3 1/8	....	....	4	2 5/8	....	....
0.2570	4 1/2	3 1/8	....	....	4 1/8	2 7/8	....	....
0.2610	4 1/2	3 1/8	....	....	4 1/8	2 7/8	....	....
0.2656	4 1/2	3 1/8	6 1/2	4 5/16	4 1/8	2 7/8	6 1/4	4
0.2720	4 1/2	3 1/8	....	....	4 1/8	2 7/8	....	....
0.2770	4 1/2	3 1/8	....	....	4 1/8	2 7/8	....	....
0.2812	4 3/4	3 3/8	6 3/4	4 1/2	4 1/4	2 31/32	6 1/4	4
0.2854	4 3/4	3 3/8	....	....	4 1/4	3	....	....
0.2913	4 3/4	3 3/8	....	....	4 1/4	3	....	....
0.2969	4 3/4	3 3/8	6 3/4	4 1/2	4 3/8	3 3/32	6 3/8	4 1/16
0.3020	4 3/4	3 3/8	....	....	4 3/8	3 1/8	....	....
0.3071	4 3/4	3 3/8	....	....	4 3/8	3 1/8	....	....
0.3125	5	3 5/8	7	4 11/16	4 1/2	3 3/16	6 3/8	4 1/16
0.3160	5	3 5/8	....	....	4 1/2	3 1/4	....	....
0.3230	5	3 5/8	....	....	4 5/8	3 5/16	....	....
0.3281	5	3 5/8	7	4 11/16	4 5/8	3 5/16	6 1/2	4 1/8
0.3320	5	3 5/8	....	....	4 3/4	3 7/16	....	....
0.3390	5	3 5/8	....	....	4 3/4	3 7/16	....	....
0.3437	5 1/4	3 7/8	7 1/4	4 15/16	4 3/4	3 13/32	6 1/2	4 1/8
0.3480	5 1/4	3 7/8	....	....	4 7/8	3 1/2	....	....
0.3543	5 1/4	3 7/8	....	....	4 7/8	3 17/32	....	....
0.3594	5 1/4	3 7/8	7 1/4	4 15/16	4 7/8	3 17/32	6 3/4	4 1/4
0.3680	5 1/4	3 7/8	....	....	5	3 5/8	....	....
0.3750	5 5/8	4 1/8	7 5/8	5 1/8	5	3 5/8	6 3/4	4 1/4
0.3860	5 5/8	4 1/8	....	....	5 1/8	3 3/4	....	....
0.3906	5 5/8	4 1/8	7 5/8	5 1/8	5 1/8	3 3/4	7	4 3/8
0.3970	5 5/8	4 1/8	....	....	5 1/8	3 3/4	....	....
0.4062	5 5/8	4 1/8	7 5/8	5 1/8	5 1/4	3 27/32	7	4 3/8
0.4219	5 5/8	4 1/8	7 5/8	5 1/8	5 3/8	3 31/32	7 1/4	4 5/8
0.4375	6 1/8	4 7/16	8 1/8	5 7/16	5 1/2	4 1/16	7 1/4	4 5/8
0.4531	6 1/8	4 7/16	8 1/8	5 7/16	5 5/8	4 3/16	7 1/2	4 7/8
0.4687	6 1/8	4 7/16	8 1/8	5 7/16	5 3/4	4 9/32	7 1/2	4 7/8
0.4844	6 1/8	4 7/16	8 1/8	5 7/16	5 7/8	4 13/32	7 3/4	5
0.5000	6 1/8	4 7/16	8 1/8	5 7/16	6	4 1/2	7 3/4	5

Kind of Shank

Straight-Shank Drills—Drills having cylindrical shanks. The shank may be the same or of a different diameter from that of the body of the drill. It may be made with or without driving flats, tang or grooves.

Taper-Shank Drills—Drills having conical shanks suitable for direct fitting into tapered holes in drilling machine spindles or driving sockets. The tapered shanks generally have a driving tang.

Taper Square-Shank Drills—Drills having tapered shanks with four flat sides for fitting ratchets and braces.

Number of Flutes

Two-Flute Drills—These are the conventional drills used for originating holes.

Single-Flute Drills—Drills used principally for drilling wood and other soft substances.

Three-Flute Drills (*Core Drills*)—These drills are used for enlarging and finishing holes. They will not originate holes because they do not have cutting edges at the center.

Four-Flute Drills—These drills are interchangeably used with three-flute drills. They are of the same construction as three-flute drills.

Rotation

Right-Hand Drills—The great majority of drills are made "right-hand"; that is, when looking toward the point with the shank extending away, they must be rotated in a counterclockwise direction.

Left-Hand Drills—These drills are made to cut when rotated in a clockwise direction; they are not used extensively.

Oil Holes

Some drills have holes through the solid metal or webs extending to the cutting lip. Holes may extend through the entire length of the drill or only through the body length.

Other drills have oil channels machined in the webs and covered. This type of drill is usually made in sizes larger than 2 1/2 in.

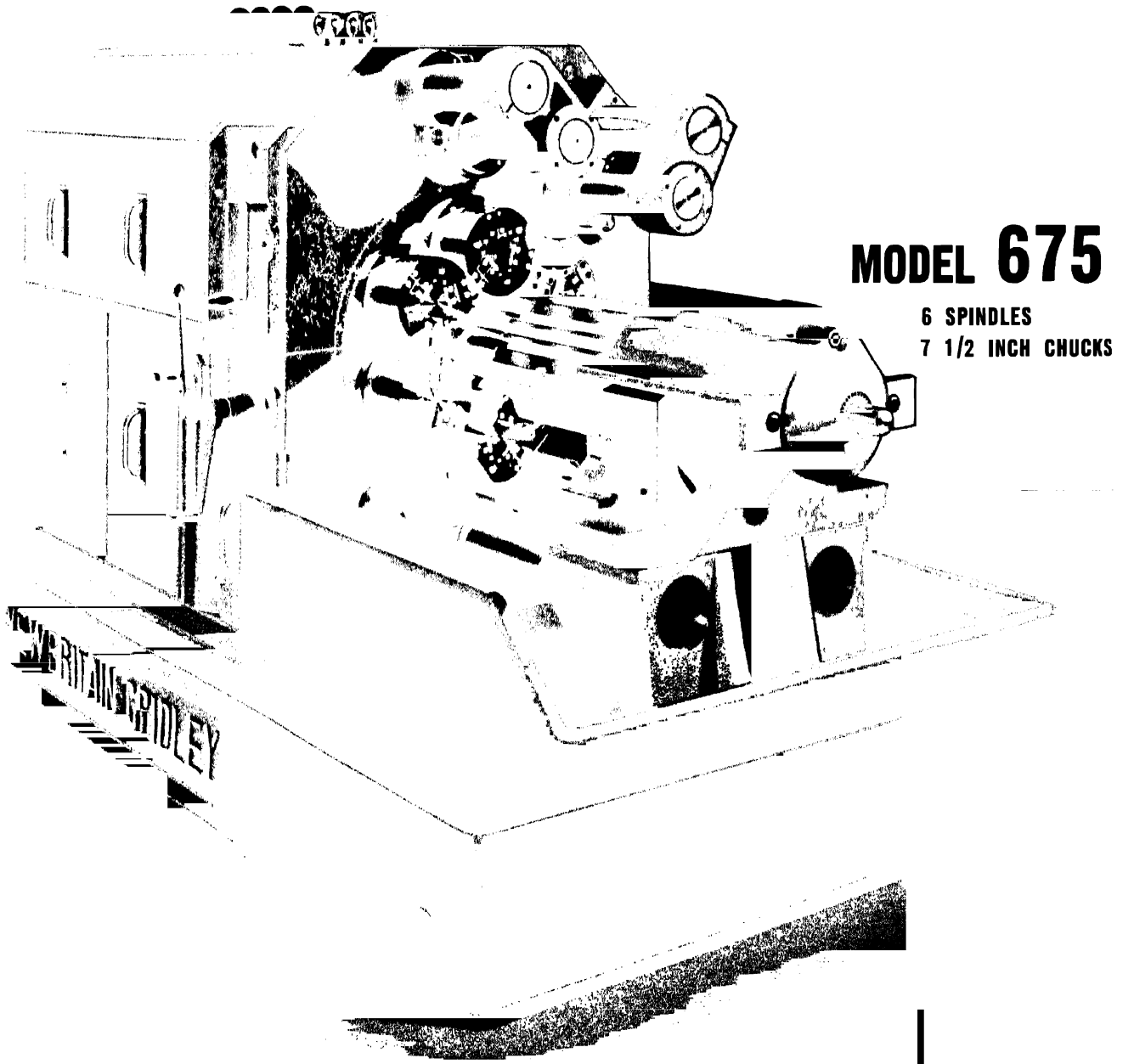
DEPENDABILITY

NEW BRITAIN Chuckers have been engineered and developed with the paramount objective of retaining initial accuracy throughout continuous production on the toughest jobs.

Exclusive Features, incorporated for PERMANENT ACCURACY, and ample rigidity for the heaviest cuts assure dependable performance at the maximum efficiency of modern cutting tools.

NEW BRITAIN-GRIDLEY

MACHINE DIVISION • THE NEW BRITAIN MACHINE CO.
NEW BRITAIN • CONNECTICUT



MODEL 675

6 SPINDLES
7 1/2 INCH CHUCKS

A complete line of Chuckers — four Six and Eight Spindles to 10 3/8" capacity
Also a complete line of Screw Machines — four and Six Spindles to 2 1/4" capacity

No Bottleneck Here

TO SAY THAT an industry is a defense "bottle neck" these days is like pointing an accusing finger at a person and saying "convicted."

That's why we strongly resent the statement that the machine tool industry is a bottleneck. For it isn't.

True, the industry is sold out months ahead. True, if it falls down on its job, the defense program will be gravely delayed. But it hasn't fallen down on its job. Mr. Knudsen, among others, has publicly testified that the machine tool industry "is cooperating 100 per cent."

We'll wager that the industry, despite the unprecedented burden on it, will be able to furnish machines just about as fast as the munitions makers can take them.

If that is done, however, it is necessary that machine tool customers do some intelligent planning and that they view matters from the national interest as well as from their individual selfish standpoints.

Does this sound vague? Well, let's be specific. What good is served if Wright Field or any other military or naval establishment should order machine tools without having an immediate destination for them and then refuse to release them to an airplane maker who badly needs them at the moment? What good is served when the British take delivery on machines which are warehoused pending a decision as to their use, when the same machines could be put into immediate production elsewhere? What good is served when an airplane engine company demands prompt delivery of machine tools to a plant as yet unbuilt?

It's the old "bird-in-the-hand" philosophy at work. Don't let anything go that you can get your hands on, because you may not be able to secure the same thing later on when you need it. It's the same sort of thinking that sends housewives out to stock up on sugar when it appears sugar may be a little hard to buy.

But if it is going to be every man for himself, it will be too bad for the defense program. That kind of thinking will do irreparable harm.

Let's look at the matter sensibly. Take a company tooling up to make tanks, for example. Instead of insisting that all of its $10,000,000 of machine tools be in place before production starts rolling in a big way, why wouldn't it be a good idea to begin manufacture as soon as enough machines have been delivered to put together a line?

Inevitably errors will crop up. A certain machine set-up may be wrong or may need modification. Some cutting tools may have to be changed. A new coolant may be necessary for a particular operation. Changes in sequence may be advantageous. As these "bugs" are removed, more machines are being delivered and by the time operations are running smoothly, everything is in.

At best, tooling for defense can move only so fast. If we can do in two years what Hitler took seven years to do, that will be a record in itself. And the machine tool industry can perform its part in this program if it maintains its present pace.

As Boss Kettering has said, and Mr. Knudsen repeated recently, "Two hens sitting on a nest won't produce eggs in half the time."

Burnham Finney

GAGING BUSINESS

Industry begins to feel full impact of the defense program. User cooperation needed to place machine tools where they will do most good. British orders swell large outlay for armament.

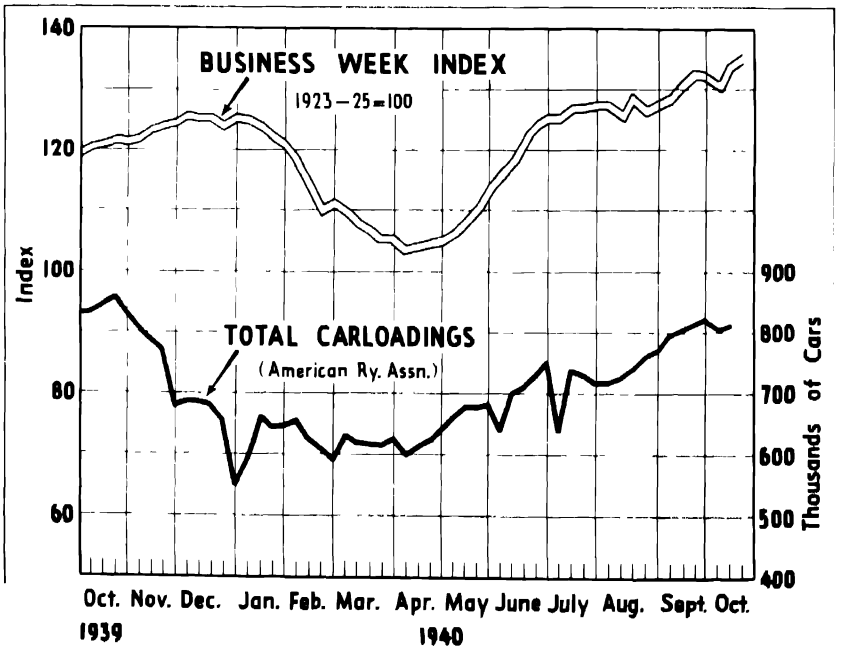
Machine Tools—More and more the industry feels the pressure of the defense program. Munitions contractors are getting orders for tanks, guns, shell and other armament items, and in turn are estimating their machine tool requirements. Four projects taken on by automobile companies will need equipment totalling in excess of $100,000,000. These projects include machine guns by General Motors, Pratt & Whitney engines by Ford, tanks by Chrysler, and Rolls Royce engines by Packard. In addition, machine tools valued at $20,000,000 will be needed by Wright Aeronautical for its new Cincinnati plant and for main subcontractors supplying parts to Cincinnati. Delivery of machine tools to defense contractors who need them immediately will be expedited if buyers will resist the temptation to demand their machine ahead of the date when they can be put to work. In several important instances machine tools have been warehoused pending installation when they might advantageously have been operated immediately somewhere else. If an orderly time-table is set up to conform with actual needs, machine tool builders are confident that they can handle defense orders without serious delay. The industry is now producing on the basis in excess of $450,000,000 a year, and will be above a $500,000,000 rate before long.

Farm Equipment and Tractors—Tractor manufacturers are now receiving some sizable defense orders. J. I. Case has been awarded a contract for 155-mm. shell valued at $4,634,000. International Harvester will forge and machine 75-mm. shell at its Milwaukee works on a recent order of approximately $1,000,000. The demand for industrial tractors continues to be good but can be handled along with the armament orders without interference.

Railroad Equipment—Buying orders are now being placed for next year's delivery as the added demand for defense items is also being felt by manufacturers of railway equipment. Contracts for forgings have been let to the American Forge Division, of the American Brake Shoe & Foundry Co., American Locomotive Co., and others. Several of Pullman-Standard's plants are in receipt of orders during the past few weeks. Infantry weapons costing $838,150 are to be manufactured at the Hammond plant, $638,150 for motors, $1,134,000 for artillery ammunition components at the Butler Division. Orders for track materials are beginning to come in for next year. The New York Central has ordered $6,650,000 worth. Southern Railway has ordered 35,000 tons of rail and the Rock Island railroad has authority to buy $3,075,000 worth of track material.

Munitions—The British have placed large orders for tanks with Pullman-Standard and with Baldwin Locomotive Works Continental Motors is understood to have an order for engines totalling $20,000,000 for these tanks, and John Inglis Co., Toronto, will furnish Bren machine guns for them. Negotiations are now on for a contract covering transmissions for the tanks. International Motors is believed to have secured an order to make more tank transmissions though not for this British contract. One of the biggest problems confronting the government is the production of small arms ammunition and machine guns necessary to arm tanks, aircraft and other mobile equipment to be built during 1941. Shell contracts are being let in increasing volume by the Ordnance Div. of the War Department.

Aircraft—Preliminary studies for American air and fleet bases on British islands in the Atlantic show that at least $500,000,000 will be required to build them. Around $70,000,000 will be needed for the base at Trinidad alone. Extensive dredging, wharves, flying fields and other facilities are planned there. The money for the Atlantic bases has not yet been appropriated. Domestic flying fields and airplane servicing facilities are entirely inadequate to handle the number of planes it is expected will be delivered in 1941. Construction and equipping of such facilities takes time. Plans for their expansion are far below requirements. The Army and Navy have had to take over some fields already, among which is Floyd Bennett in New York. Many more will have to be used partially or entirely by the two arms of the service. Regular transport air lines can hardly escape interference at numerous ports from Army and Navy operations. Two additions to the Pratt & Whitney aircraft engine plant were dedicated last week by Major General H. H. Arnold, chief of the Army Air Corps. Known as the "British additions" because they were financed by British capital, these plants add 400,000 sq. ft. of floor space, and represent the third major increase in manufacturing capacity since January, 1939.



Defense Commission Sets Up Plan To Increase Skilled Labor Supply

WASHINGTON—A "Training within Industry" program has been set up by the Defense Commission It is modeled on methods already in use by some manufacturers in urgent need of skills, and is commonly called "up-grading" In a word, the employer simply trains workers on minor jobs for promotion to jobs requiring greater skills, meanwhile feeding untrained men in at the foot of the line

The program was started in a small way a couple of months ago It is under direction of the Commissions Labor Division, which is headed by Sidney Hillman The plan will be in full operation in another couple of months It will be directed from 22 division offices to be set up in as many industrial regions

Three men are in direct charge of the program C R Dooley, industrial relations man for Socony Vacuum, Walter Dietz, personnel director of Western Electric; and William Conover, United States Steel of Delaware These men are on loan to the Government, without pay

The plan is to get men from industry, who have had the right type of personnel training experience, and have them serve as "instructors" for the various industrial regions Actually, the Commission is serving as liaison between defense equipment manufacturers for the exchange of "up-grading" information There are no appropriations involved and very little expense

There is nothing new or experimental about this program, it's as old as apprenticeship However, the plan is called into wide use now because of urgent need for more skilled men The Defense Commission is now helping to guide such training in instrument making in lens grinding, in airplane engine building and other lines In addition to regular up-grading, the Labor Division's program includes training workers in occupations requiring only a single skill and developing supervisors by giving them progressively increasing responsibility

Soviet Will Spend $30,000,000 In U. S. for Tools and Machinery

NEW YORK—Soviet orders for more than $9,000,000 of heavy equipment were placed in the U S last month and an additional $30,000 000 worth of goods will be purchased here before the end of the year The Soviet buying is a direct result of the more lenient attitude taken by the government here in the matter of export licenses for the goods Russia needs Earth-moving and hauling equipment, drilling machinery and railroad equipment will be purchased in large quantities

Voluntary System of Priorities Still in Effect Despite Appointment of Priorities Board

WASHINGTON — Headlines to the contrary, the President's appointment of a priorities board and naming as priority administrator Donald Nelson Defense Commission procurement coordinator makes no concrete immediate change in the priorities situation Still in effect and still voluntary is the voluntary priority system instituted by the machine tool industry some months ago Nelson tells AMERICAN MACHINIST that he has no specific case in mind in which to *recommend further priorities to the* board which is composed of defense commissioners Knudsen Stettinius and Henderson

Immediate duties of the board and administrator, according to Nelson will be (1) to establish policies, (2) to adjust problems between contractors and Army and Navy that cannot be settled by the priorities committee of the Army and Navy Munitions Board and (3) to handle problems outside the jurisdiction of the Army and Navy committee

Major significance of the appointments, apart from a somewhat political timing is that responsibility for priorities is shifted from military to civilian hands This foreshadows the increasing necessity for coordinating civil and military needs as opposed to mere relative scheduling of different military orders

Along the same line was Nelson's simultaneous appointment of Albert J Browning of Montgomery Ward, to represent Nelson in his capacity as procurement coordinator in the Quartermaster's office The commission has several times lately taken occasion to spank the Army publicly for pushing out orders so timed as to disorganize the markets

The President's move does however, *bring mandatory priorities one* technical step nearer It also sets the machinery to study some of the questions now arising, such questions as what to do about sub-contractors who need a higher priority than their prime contractor, what to do about occasional violations that are cropping up.

LARGE AMMUNITION ORDERS

WASHINGTON—The War Department has recently ordered artillery ammunition components valued at approximately $67 000 000 Among firms receiving large orders are Eastman Kodak Co Rochester, N Y., $12 000 000, Budd Wheel Co, Detroit, $7 813 380, Tennessee Coal, Iron & R R Co, Birmingham, $5,823,600; and Willys-Overland, $5,100,040



British Combine

Tanks for England—*In Australia the munitions industry has been growing ever since England's entry into World War II Tanks guns, shells and soldiers are being sent to Britain to help in the struggle Above, a line of light tanks near completion at an ordnance factory in Melbourne*

Machine Tool Builders in Convention Discuss Relation of the Industry to Defense Problems

CHICAGO—National defense occupied the attention of machine tool builders to the exclusion of all other matters at the thirty-ninth annual convention of the National Machine Tool Builders' Association at the Edgewater Beach Hotel, October 24-25 An entire session was given over to an off-the-record discussion of defense problems as they impinge on the machine tool industry A large portion of the program the second day also was devoted to defense matters, including an open forum discussion

"We want it definitely understood that insofar as the national defense program depends on the machine tool industry, we are resolved that we shall not be found lacking, and that as individuals, as companies or as an industry we will find the means to furnish the machine tools needed," declared John E Lovely president of the association and vice-president, Jones & Lamson Machine Co, in his address "Essential Elements of a National Defense Program"

Machine Tool Industry Capable

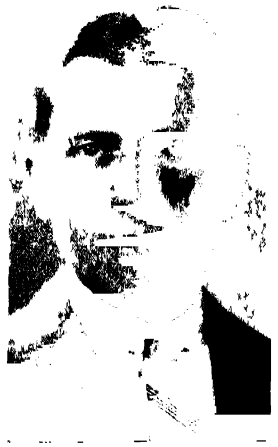
"So far we have taken care of all demands made on us We will continue to do so if an orderly program is presented and planned out a reasonable time in advance What the eventual size of the defense program will be, only coming world events will reveal If it is limited to the program covered by legislation already passed, we are confident our industry will take it in its stride If the present program is merely a starter, then I know ways will be found of taking care of the added problems as they materialize"

Mr Lovely said that "We are keenly conscious that on our industry alone falls the responsibility for supplying the machine tools needed by the defense of our country The manufacture of machine tools is so technical and highly specialized that only those experienced in it can solve the problem" He said further that "The intensive development here of high production machine tools has been both the cause and the result of the tremendous industries in the United States Our machine tool industry has been developed to take care of the demands of our own huge industries and at the same time has served the demands in other countries We are now actually hitting our stride in converting this huge industrial capacity, the greatest in the world, to production of material for defense"

The speed and power of the defense program, declared Mr Lovely, 'involve the solution of great engineering problems These problems are not yet fully recognized It seems obvious that what the defense program needs is a clearly defined program and a clearly defined time table The biggest need of our industry is to know what our full task is to be and when it should be done"



CLIFFORD STILLWELL



FREDERICK V. GEIER

The preference system for machine tools, whereby the Army and Navy Munitions Board is setting priorities on all of its requirements, is the result of fine cooperation between army and navy officers, members of the National Defense Advisory Commission and the industry, said Mr Lovely The two service branches appreciate the importance of the new instruments of mechanized warfare and realize that warfare must now be conducted by machines

Mr Lovely recited that fact that just as the industry is embarking on the defense program, it is operating at a higher rate than ever before in its history to a large extent because of the recent demand for machine tools from abroad If that export business had not been available the industry would be in a poor position today to take care of the extraordinary requirements of the defense program The industry produced $185,000,000 of machine tools in 1929 sank to $22,500,000 as an annual average for 1932 and 1933, rose to $85-000,000 in 1935, and in 1937 went up to $220 000,000 Output in 1938 fell to $120,000,000, a large portion of which was for foreign delivery In 1939 thanks again to export orders, production increased to $200 000,000 This year total output will be an all-time high or roughly $400 000,000 In August the industry was turning out machine tools at a rate of $450 000 000 a year, just double the rate of August 1939 Production in 1941 will greatly surpass that figure



L W SCOTT ALTER

Expansion Problems Cited

Present output can be increased states Mr Lovely, "by the additional use of existing plants and facilities by farming out work to more subcontractors, and by the further expansion of some of our plants and the addition of still more equipment All three methods have been employed the past year and will be continued"

Many machine tool builders, said Mr Lovely, "have expanded their plants and purchased additional machine tools to increase their own capacity before they were sure that their purchases would be needed, before they knew what the rules of the game would be, before knowing what

ELECT NEW OFFICERS

CHICAGO—Frederick V Geier, Cincinnati Milling Machine Co, has been elected president and Clifford Stillwell, Warner & Swasey Co, first vice president of the National Machine Tool Builders Association Other officers include George H Johnson, Gisholdt Machine Co, second vice president, E C Bullard, Bullard Co treasurer L W Scott Alter American Tool Works Co and David Ayr, Hendey Machine Co, have been named directors for three years



DAVID AYR

the rate of tax would be and before they knew how they were going to pay for the added facilities they were acquiring We know our industry is over-expanded already for the normal peacetime business of the country and that therefore the expansion which have been made to take care of the defense program and the further expansions that may become necessary should qualify for certification under the terms of amortization in the new tax bill

Our plants must be maintained in liquid condition and kept in workable order It is not only a fair thing but a vital thing to our country that our industry be maintained in a healthy condition The rush of work prevents operation at maximum efficiency The forced training of new men and the necessity of using newly trained men results in a loss of time and spoilage of work if not kept in proper bounds We do feel therefore that government must be sympathetic to business and that business must be treated in such a manner that it will survive this emergency rather than be sacrified to the emergency"

It is apparent that no one knows what machine tools will be required until the defense program has developed to a point where it is definitely known what types of machine guns aircraft and tanks are actually to be ordered, what the designs will be and what the quantities of each type will be, remarked Mr Lovely "Contracts must then be awarded to the people who will make them after which each contractor must find out how to make what he is to build, what machine tools he will need for each component part, what existing machine tools are available, and what added machine tools he must order

"These vital new machine tools must be made of the right size and type, and each must be equipped in such a manner that each will do its appointed job Until the program reaches the stage where each individual contractor can place his orders for the exact machine tools he needs, the machine tool builder is unable to plan his part of the program We are just reaching this stage"

U. S. Government Contracts Awarded to Metal-Working Firms

Contractor	Gov't Agency	Commodity	Amount
International Flare Signal Div Kilgore Mfg Co Tippecanoe City Ohio	War	Ammunition components	$124 530
Allis-Chalmers Mfg Co Milwaukee Wisc	Navy	Forgings	178 350
Heppenstall Co Pittsburgh Pa	Navy		872 996
The American Brass Co Waterbury Conn	War	Cartridge cups	418 575
Revere Copper & Brass Inc Baltimore Md	War		368 100
Monarch Machine Tool Co Sidney Ohio	Navy	Lathes	119 463
W F Shipley Machy Co Philadelphia Pa	War		118 415
Goss Printing Press Co Chicago Ill	Navy	Plant equip	503 490
Pump Engineering Service Corp Cleveland Ohio	War	Pumps	184 872
Boeing Airplane Co Stearman Aircraft Div Wichita Kan	War	Airplanes	6 933 096
General Motors Corp (Chev Div) Detroit Mich	War	Trucks	10 040 418
National Pneumatic Co Inc Rahway N J	War	Artillery material	178 100
Ransome Concrete Machine Co Dunellen N J	War		140 803
Hamilton Mfg Co Chicago Ill	War		384 270
Western Austin Co Aurora Ill	War		240 280
Cleveland Tractor Co Cleveland Ohio	War	Tractors	185 717
Charles Lischer Spring Co Brooklyn N Y	War	Small arms material	101 880
Bohn Aluminum and Brass Corp Detroit Mich	War	Ammunition components	117 685
Delco Products Div of General Motors Corp Dayton Ohio	War		115 650
Worth Steel Co Claymont Del	Navy	Steel	1 343 005
Carnegie Illinois Steel Co Washington D C	Navy		4 896 464
National Pneumatic Co Inc Rahway N J	War	Guns	5 931 526
York Safe & Lock Co York Pa	War		2 914 721
General Electric Co Schenectady N Y	War	Howitzers	1 750 826
Westinghouse Elec & Mfg Co E Pittsburgh Pa	Navy	Boring mills	131 000
American Car & Foundry Co Buffalo N Y	War	Ammunition components	6 040 000
Armstrong Cork Co Lancaster Pa	War	"	822 000
Babcock Printing Press Corp New London Conn	War		607 500
National Supply Co Spang Chalfant Div Ambridge Pa	War		501 500
S A Woods Machine Co Boston Mass	War		1 501 344
J I Case Co Racine Wisc	War		1 034,500
National Tube Co McKeesport Plant McKeesport Pa	War		3 365 000
General Railway Signal Co Rochester N Y	War		975 000
Pratt Industries Inc Frankfort N Y	War		236 241
National Tube Co Pittsburgh Pa	War		291 147
Lansdowne Steel & Iron Co Morton Pa	War		170 040
Yellow Truck & Coach Mfg Co Pontiac Mich	War	Trucks	104 952
Struthers Wells Titusville Corp Titusville Pa	War	Artillery material	127 000
Bethlehem Steel Co San Francisco Calif	Navy	Tools equipment etc	10 013 000
Bethlehem Steel Co Quincy Mass	Navy		13 427 500
New York Shipbuilding Corp Camden N J	Navy		10 500 000
Bethlehem Steel Co Staten Island N Y	Navy	Cruisers & Liners	2 706 000
Gulf Shipbuilding Corp Chickasaw Ala	Navy		2 500 000
Seattle Tacoma Shipbuilding Corp Seattle Wash	Navy	Plant facilities	4 600 000
Electric Boat Co Groton Conn	Navy		2 750 000
Consolidated Steel Corp Orange Texas	Navy		4 600 000
Manitowoc Shipbuilding Co Manitowoc Wis	Navy		1 000,000

More New Canadian War Plants Begun; Will Produce 3,000 Tanks

MONTREAL—To date the British and Canadian governments have made commitments of $250 000 000 for the construction of new war plants in Canada The plants will be government owned War orders placed to date by Canadian Dept of Supply (or predecessors purchasing boards) approximate $550 000 000, of which 86 per cent have been awarded to Canadian concerns 9 per cent to England and 5 per cent to the U S

Latest of Canada's war production plans include the output of 3,000 tanks for which $150 000 000 will be needed to provide necessary facilities The government has given Canadian Vickers Co Montreal, an order for six large steam-driven minesweepers for the Canadian Navy to cost $600 - 000 each, as part of its $60,000,000 ship building program Naval boats now ordered from Canadian shipyards total 98, including 34 minesweepers, 10 submarine chasers, and 64 corvettes

Canadian aircraft companies expect to be producing 350 to 380 airplanes a month by early 1941 if they can continue to get the necessary trained labor The production schedule for next year calls for 4 200 to 4 500 planes ranging from light pilot trainers to heavy bombers By the end of this year 1 300 planes will have been turned out

Recent orders given by the Dept of Munitions and Supply are Aircraft Aviation Aviation Electric Ltd Montreal, $50 065, National Steel Car Corp, Ltd, Malton, Ont, $10 324; Canadian Car & Foundry Co, Ltd, Montreal, $632,205, and Noorduyn Aviation Ltd, Montreal $21 944 Machinery, Williams & Wilson Ltd, Montreal, $85,436, Canadian Fairbanks-Morse Co, Ltd, Ottawa, $133 331, Modern Tool Works, Toronto, $148,651, J H Ryder Machinery Co Toronto $118 987; John Bertram & Sons Co, Ltd, Dundas, Ont, $556,-331, Ford Motor Co of Canada Ltd, Windsor, Ont, $250,000; and John E Livingstone Machinery Co, Ltd, Windsor, Ont, $140,135. Ordnance British War Office, $1,060,000, and Hugh Carson Co, Ltd, Ottawa, $11,000

Engineering Education Main Topic At Recent A.S.T.E. Semi-Annual Meeting

CINCINNATI—Tours through fourteen local plants, technical sessions on gear finishing, a forum on engineering education, and a convention dinner kept members of the American Society of Tool Engineers busy during their three-day, semi-annual meeting held here Oct. 17, 18 and 19. Whiting Williams, noted industrial consultant, writer and lecturer was the principal speaker at the dinner Friday evening.

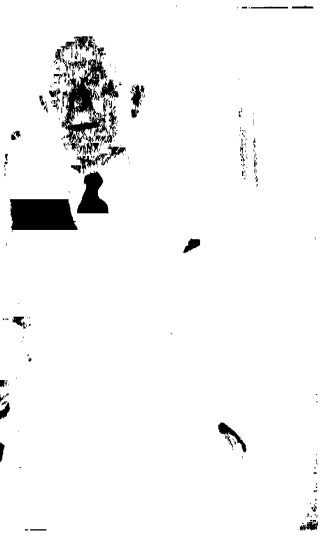
The Thursday evening session on education included talks by F. E. Searle, head of Ford Trade School, Dr. R C. Gowdy, dean, College of Engineering and Commerce, University of Cincinnati, W. S. Dowman, assistant director of sales and office personnel, the Goodyear Tire & Rubber Company, and George Shiele, chief inspector, Cincinnati Milling Machine Company. The subject of the forum was "Should Industry Assume the Burden of Special Education."

Favor Industrial Training

In the preliminary report of the Society's Committee on Education, presented at the dinner on Friday Evening by H. D. Hall, committee chairman, it was indicated that the committee favors courses in high schools and colleges which would prepare the average student for any kind of situation in industrial plants. The Committee has suggested the possibility of combining the best features of vocational training and general academic studies in high school curriculum

In his report to the Society, President A H. d'Arcambal, emphasized the problem faced by the metal-working industry in the shortage of skilled men. A recent A.S.T.E survey found a shortage of 40,000 tool engineers, 125,000 tool and die makers, and 400,000 skilled workers Mr. d'Arcambal estimated that these figures probably can be doubled because of the added demand for workers needed to man plants being constructed under the Defense Program.

Speakers at the Saturday morning technical session on gear finishing included Charles R Staub, chief engineer, Michigan Tool Co., Otto H Schafer, president, Schafer Gear Works, I. J. Gruenberg, chief engineer, Gear Grinding Machinery Company, and Charles Pfeffer, gear development and production, Wright Aeronautical Corporation. Most of the discussion was given over to consideration of shaving, lapping and grinding processes as applied to gear finishing problems



B. B. Quillen (above), president, Cincinnati Planer Co., welcomed A.S.T.E. members at the dinner on behalf of the Cincinnati machine tool industry



At the left, I.S.T.E. president A. H. d'Arcambal had time for a joke with A.S.T.E. members B. G. Tang of General Electric Co. and J. R. Weaver of Westinghouse Electric & Mfg. Co.

At the right, Jack C. Carlton, president, Carlton Machine Tool Co., Ross S. Hambleton, machine shop superintendent at Wright Aeronautical's new plant in Cincinnati, and P. W. Brown, general superintendent, Wright Aeronautical Corp., came early for the A.S.T.E. dinner Friday night





Speakers at the session on gear finishing were I. J. Gruenberg, Gear Grinding Machinery Co., and C. Pfeffer, Wright Aeronautical



Charles R. Staub and executive v-p Marvin Anderson, Michigan Tool Co., were co-authors of a paper on gear finishing



O. H. Schafer, Schafer Gear Works, and R. M. Lippard, Heald Machine Co., were among the more than 500 registered

WATCHING WASHINGTON

Attempt to deny defense orders to violators of Wagner Act has brought no definite results. Aluminum and Tin facilities will be greatly expanded in U. S. Lag seen in airplane production

By BLAINE STUBBLEFIELD

WASHINGTON—The Hillman-Jackson attempt to enforce the Wagner Act by having the federal procurement agencies refuse orders to firms accused of violating the Act, still has brought no definite results. It is the type of thing that politicians let ride down the middle of the road and that is what they are still doing, as AMERICAN MACHINIST predicted in its last issue. Following the publicly expressed wish of Sidney Hillman that low-bidder awards, as well as negotiated awards, be refused to law violators, Sec. of War Stimson, has now asked the U. S. Comptroller General Elliot for a ruling on that question. But is is believed here that Stimson merely wanted to get cleared legally for any case that might come up. The Comptroller General is often asked such important questions, because he must see that all moneys are disbursed according to law

Mr. Elliot's reply boils down to this: Under defense law, the procurement agencies have the right to reject *all* bids and negotiate with bidders or non-bidders on the terms advertised. Therefore, there is no legal prohibition against the rejection of low bids which are consistent with principles applied in negotiation of awards. In other words, the bid system still exists only as a formality, though many administrators, such as Donald Nelson, co-ordinator of defense purchasing, see danger in its abandonment.

Opinion here is that NLRA violators will be admonished quietly by the Army-Navy-Defense Commission team to be good. Openly recalcitrant manufacturers may be publicly denied orders to placate organized labor. If you are trying to figure it out along normal lines of thought, just remember that on one hand you have a law under which the Government can confiscate plants for refusal to take orders, and on the other, a law that threatens to deny orders to firms. Actually, there will be very little confiscating and very little order-refusing.

Aim Plane Standards at Britain

The committee on standardization of plane output appointed by the President (Knudsen, Stimson, Knox, Morgenthau) has little to do with standardization of airplane types However, the administration is not averse to letting the public, thoroughly sold on that objective, get such an impression. Real purpose is to put some high-power names behind an effort to get the British to accept U. S. standards as to details of the planes they buy. This is particularly important in cases where the British are buying substantially the same ship as this government, such as the Curtiss P-40 or the Bell P-39.

Brunt of this effort falls on the standardization committee of the Army-Navy Aeronautical Board; this committee works on the interchangeability of parts as between different Army, Navy, and British models. At present it is working at the level of the thread of screws and the location of holes on a generator pad; eventually it will work as far up toward more important sub-assemblies as it can go without upsetting production.

Plane Output Lag Hurts Britain

Hardest hit by the current lag in airplane production behind the scheduled rate are the British. Total output, scheduled to rise from 900 units in August to 1,150 in October and 1,250 in January is actually riding along at 900 to 950 ships. Even worse, from the British viewpoint, total production is only holding constant because a rise in trainer output is compensating for an actual drop in production of combat types. These are naturally most affected by re-tooling and plant expansion interference. And for the present, production for Britain is almost synonomous with production of combat types. In August, the British and Canadians received 350 planes, but in September this dropped below 300; it is unlikely to rise much beyond this in October.

These initial delays, however, are unlikely seriously to affect the fulfillment of the two-year program This calls for a total production by July 1942 of 35,800 units—though if hoped-for schedules are achieved this output may be accomplished a few months earlier. Of these, Britain will get 14,300, by present plans, consisting of 11,870 combat ships and 2,430 trainers. The Air Corps, which has already placed orders extending beyond the 35,000-plane program, will get 8,225 combat ships and 6,175 trainers during the next year and a half—a total of 14,400. Navy ships, totalling 7,100 will be divided between 5,325 combat types and 1,775 trainers. Navy, incidentally, has so far scheduled only about 6,000 of its planes and has not awarded contracts for all of these.

Increase Aluminum and Tin Supply

New steps have been taken to provide adequate supplies of aluminum and tin, both vital to defense. Stettinius announces that Aluminum Company will add three new units to its Bonneville and Alcoa plants, which will increase production by 90,000,000 pounds annually. This country's aluminum capacity in 1939 was 325,000,000 pounds; present capacity is 450,000,000; by July 1942 it will be 700,000,000 pounds.

Stettinius said we have an adequate supply of bauxite, and that increasing facilities for fabricating sheets, shapes, forgings, castings from ingots will meet defense needs. About 55% of bauxite comes from Dutch Guinea and most of the balance from Arkansas. Aluminum Company also filed with Federal Power Commission its intention to construct a 100,000 kw hydro-electric project near Alcoa, N. C., for completion in three years

With $15,800,000 loan from RFC, Reynolds Metals Company starts immediate construction of a plant at Sheffield, Ala., to be in production in 1941, with a capacity of 60,000,000 pounds annually.

RFC's Metals Reserve Company has agreed with producers in Bolivia to purchase enough concentrates to smelt about 18,000 tons of fine tin per year for five years.

SEE AID FOR MACHINE INDUSTRY

WASHINGTON — Government authorities close to the President have come to the conclusion that the machine productive capacity of the country should be carried by the government at whatever level above peace time needs may be necessary to avoid such a lack as is now being experienced. In their opinion it is better for the government to carry the burden of the supporting of the excess capacity than to go to the great cost of obtaining the capacity when needed. The safety of having the output would entirely offset any annual outlay for the maintenance involved. There is no need for the government to have any say in the operation of the business it would assist.

National Metal Show Introduces Materials And Methods to Aid National Defense

CLEVELAND, OHIO—Proper utilization of metals for items of national defense was the central theme of the National Metal Congress held at Cleveland, October 21-25. The Congress included the National Metal Exposition and technical sessions arranged by the four sponsoring societies, the American Society for Metals, the American Welding Society, the Wire Association and the American Institute of Mining and Metallurgical Engineers.

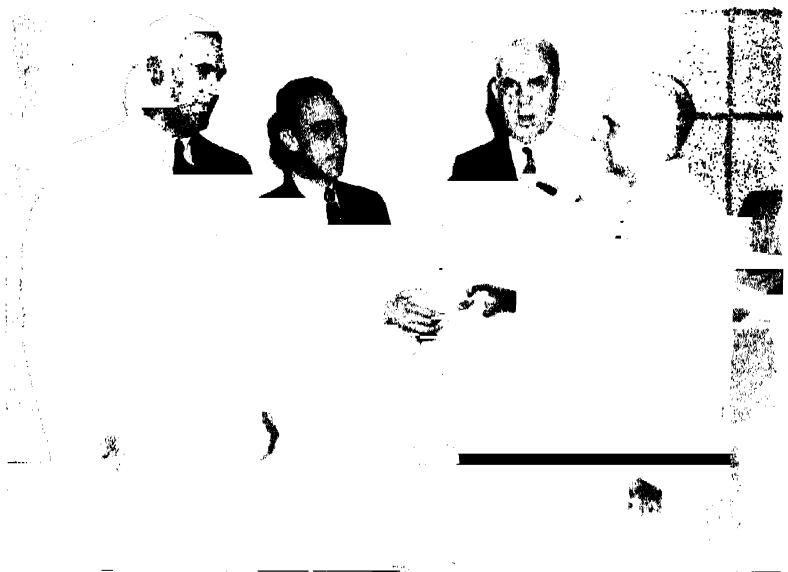
Heat-treating equipment exhibited at the show reflected further refinements in the control of furnace atmospheres to give the proper chemical relation between metal and gas during the heating cycle. Westinghouse demonstrated its Endogas furnace which produces clean and scale-free hardened steels. The atmosphere obtained from fuel gas in a reaction unit is controlled by a direct reading gage to give the desired "carbon balance." The Ammogas process, shown by the same manufacturer, is designed for the bright hardening of dies.

The "Bell-Oven" furnace, displayed by American Gas Furnace Co., has a covering or bell over the work resting on the furnace hearth. The desired atmosphere is inserted from above. The bell is automatically raised when the furnace door is opened but at other times protects the work by means of a gas-tight seal. Despatch Oven Co. demonstrated further refinements in its line of recirculating air furnaces which are particularly adopted to heat-treating and annealing non-ferrous metals such as aluminum alloys, brass, copper and bronze. In these furnaces combustion takes place in a separate chamber and is circulated around the work by means of forced draft to give uniform heating. The Lindberg Engineering Co. showed the "Cyclone" forced circulation electric tempering furnace developed for the heat-treatment of parts for the aircraft industry.

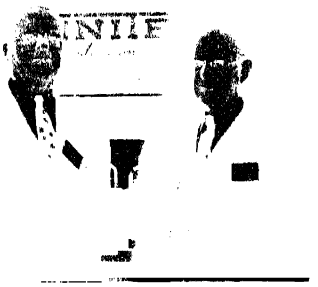
The feature of Surface Combustion Co.'s booth was its automatic annealing unit for wire, also suitable for tinning or enameling. The wire is heated directly in a gas flame and quenched in circulated water while unreeling from one spool and winding on another.

A vertical furnace for wire and strip annealing was displayed by the Selos Co. This unit combines continuous operation with the use of the radiant-heat gas burner introduced by this concern. A muffle furnace operating directly from city gas without the use of fans or blowers, was shown by Charles A. Hones, Inc., for use on high-speed steels.

The Ohio Crankshaft Co. has extended its line of Tocco Jr. induction machines for the surface hardening of small parts. By the use of simple fixtures, these units are applicable to a wide variety of work. Induction heating is used also by the Ajax Electrothermic Co. for heating steel bars to forging temperature in the manufacture of shell. Another method for raising shell stock to forging temperature has been developed by the Electric Furnace Co. This method uses a special rotary furnace and has been applied to the heating of 155-mm. shell.



T. N. Armstrong, Jr. and H. J. French, International Nickel Co., receive the Lincoln Gold Medal from Professor Le Roy W. Clark, Rensselaer Polytechnic Institute, while George T. Horton, retiring president, American Welding Society looks on



S. O. Bjornberg and F. W. England were justifiably proud of the gear measuring devices introduced by the Illinois Tool Works

Among the advances in temperature control devices was that shown by C. J. Tagliabue Mfg. Co., which gives multiple indicating control for six furnaces in one instrument. Successive readings for each furnace are given by a series of lights which indicate the furnace being measured and whether it is below, above or within the required temperature.

In the field of oxyacetylene welding, chief emphasis is placed on flame-cutting, flame machining and flame hardening. The Air Reduction Co. had nineteen different models of flame-cutting machines alone, including templet cutting, structural shape cutting and other devices. Also exhibited was a flame-hardening machine for handling round sections in a vertical position. The Linde Air Products Co. demonstrated a flame-cutting machine which will automatically cut either square or round sections. This unit is particularly suitable for cutting off stock for the manufacture of shell forgings.

The National Cylinder Gas Co. now distributes electric welding equipment through its subsidiary, the Hollup Corporation. This concern showed a multiple flame-cutting machine using four torches simultaneously. Una Welding, Inc., displayed a new portable welding unit complete with speed controls and automatic feeds. The flux is spread in ribbon form and wrapped around the bare rod, making possible some 80 combinations to suit specific materials.

General Electric Co. has developed new lines of welding electrodes suitable for national defense.

A new coated aluminum-bronze welding rod supplied by Ampco Metal, Inc., may be used for arc or gas welding without preheating the base metal. Six grades are available.

The rods are useful in coating surfaces of large forming dies.

Sciaky Corporation showed for the



T. C. Smith, J. J. Warren and A. F. Moranty (left to right) help display Leeds and Northrup's line of furnaces and temperature control instruments. C. H. Stevenson, R. S. Aitcheson and L. A. Lindberg were on hand to explain Lindberg Engineering Company's new developments. W. J. Donnelly, Charles J. Hones and Charles A. Hones showed gas fired furnaces at the Charles A. Hones, Inc. exhibit

first time in this country its spot welding machine which was developed in France and is now coming into use in the aircraft industry for welding aluminum alloys and stainless steels. Also being applied to armament manufacture is the resistance welder made by Federal Machine & Welder Co. for use on projection, strap and butt welding. This equipment makes use of the condenser discharge which permits its use on standard line voltages. Progressive Welder Co. attracted attention with its hammerweld machine particularly useful on heavy stock and where scaly conditions exist.

The Master Mind shown by Harris Calorific Co. uses a signal system to measure the efficiency of a welder's work during the process of welding. A red light flashes on when the flow of metal across the arc is not satisfactory, giving a poor weld. A green light indicates a good weld. Timing clocks can be used in the circuit to record the final ratio of good and bad welds.

In the development of new metals attention has been given to alloys which are not dependent on imported materials that might be difficult to secure during an emergency. The Otis Steel Co.'s Otiscoloy, a low alloy, high tensile steel, is said to have exceptional welding properties because of the absence of hardening elements.

Chromium-boride alloys previously marketed as hard facing compounds under the name of Colmonoy, are now available as sand castings furnace-welded to back-up pieces. The material has been found useful on such parts as centerless grinder rests, gages, steam valve seats and chuck jaws. Revere Copper and Brass Co. has developed a 90 per cent copper, 10 per cent aluminum alloy which forges readily. It has high physical properties with a yield point of about 35,000 lb. per sq.in. Chase Brass and Copper Co. has a new silicon-bronze welding rod designed for the oxy-acetylene welding of red brass and copper. This concern has also developed a new tellurium copper combining forgeability and machinability.

Stamping dies for sheet metal may be made quickly and cheaply through the use of "Kirksite A," a new alloy developed by the National Lead Company. This method is applicable in forming aluminum sheet for aircraft.

In the field of metal finishing, duPont demonstrated a novel process of plating brass two to four times as fast as older methods. The method gives a bright finish with heavier deposits than have heretofore been possible. National Machine Works showed an immersion heater for pickling tanks. The heating element is incased in a housing of bonded graphite which withstands the acid.

Devices for testing displayed at the show include Sperry Products detectors for flaws in steel. This method is particularly adaptable for the mill inspection of steel tubes by means of electric detection coils, which operate a signal lamp and stop the feed of material as soon as a flaw has been encountered. The Brush Development Co. demonstrated its method for the measurement of surface finishes. The surface analyzer employed has a sapphire tracer point which transmits its motion through an amplifier to an oscillograph to give an exact record of surface roughness.

The Metal Congress saw the installation of Dr. O. E. Harder, Battelle Memorial Institute, as new president of the A.S.M. The annual dinner at which Dr. Harder took office was addressed by General Hugh Johnson. The Campbell Memorial Lecture was delivered by S. L. Hoyt, also of the Battelle Memorial Institute. A. W. Machlet was awarded the Sauveur medal.

A. W. S. awards included the Lincoln gold medal which went to H. J. French and T. N. Armstrong, Jr., both of the International Nickel Co. Their paper "Weld Hardening of Carbon and of Alloy Steel" was considered the year's outstanding contribution. The Samuel Wylie Miller memorial medal went to William Spraragen, technical secretary of the American Welding Society and editor of *The Welding Journal*.



W. B. Pierce and R. W. Dietrich (left to right) kept busy in the Rustless Iron and Steel Corporation's booth. Dr. E. C. Bain, U. S. Steel Corp., flexes a rapier made by the Austempering process of which he is co-inventor. D. G. Clark and Malcolm Judkins explained the merits of Firthite and other Firth Sterling Steel Co. products

Associated Machine Tool Dealers Discuss National Defense Problems at Annual Meeting

DAYTON, OHIO—Problems of national defense affecting the machine tool industry formed the main discussions at the annual meeting of the Associated Machine Tool Dealers of America at the Dayton Biltmore Hotel October 21-22. In addition to the two-day sessions and the dinner, a trip to the Monarch Machine Tool Co. at Sidney, Ohio, as guests of Wendell E. Whipp, president, was a feature of the convention.

Defense demands on the machine tool industry will amount to $600,000,000 a year for the next two years, predicted A. B. Einig, Machine Tool Division, National Defense Advisory Commission. In general, machine tool deliveries are now extended to about the middle of 1941. He emphasized that buyers must have the vision to anticipate their machine tool demands sufficiently far ahead; if they do, there will be no serious jam in the industry.

Mr. Einig estimated that gage requirements for defense the next two years will total $16,000,000. Gage makers today are turning out $4,000,000 of goods annually and may be able to get up to $6,000,000. This country has the task of creating two new industries: one for manufacture of precision instruments which can no longer be obtained from France and Switzerland, and the other for production of industrial jewels.

Increase Machine Tool Output

Machine tool builders have done a fine job, in Mr. Einig's judgment. Today the industry is employing upward of 70,000 men and its productive capacity is far in excess of 1917, the last time that a national emergency existed. It has enlarged its output from $22,000,000 a year in 1932 to $400,000,000 this year.



W. E. Whipp, president, Monarch Machine Tool Co., and John Sauer, Jr., Peninsular Machinery Co., Detroit, attended the meeting

If machine tool users will be satisfied to get enough machines to start a line, such as for tanks, and then discover the inevitable errors in their processing methods and correct them, before insisting upon having a complete mass production set-up, the machine tool industry will be able to supply their needs as fast as they arise, declared Tell Berna, general manager National Machine Tool Builders' Association. Unintelligent planning is causing some confusion and delay.

The big job before the machine tool industry, according to Mr. Berna, is to persuade customers to take deliveries consistent with their needs. He advised users to secure written

Dealers V-President



ALBERT M. STEDFAST

priorities instead of verbal ones covering their orders. The delivery date on an order with a preference rating is more important than the rating itself. The name "preference ratings" was chosen in Washington deliberately to emphasize the voluntary nature of the system of voluntary priorities.

The British are now preparing an orderly program and are in the process of working out priority ratings which dovetail into the U. S. defense program, stated Mr. Berna. Some production lines in England are 80 per cent completed, and need only that extra 20 per cent of machines to get going on munitions. Mr. Berna said that the machine tool industry would produce goods valued at more than $500,000,000 during 1941. He remarked that the demand for shell machinery had not been so great as the Ordnance Department had anticipated.

There is no government plan at present to commandeer machine tools on domestic order, pointed out Al-



Frederick B. Scott, Jr., Syracuse Supply Co., was elected president of the Associated Machine Tool Dealers at the annual meeting

bert M. Stedfast, Stedfast & Roulston, Inc., Boston, in his paper on the government's program. He stressed the fact that the National Defense Act of 1916 gives the President authority to enforce domestic priorities whenever necessary. That law has been reenacted as part of the Selective Service Act without regard to a state of war. Several thousand machine tools for which export licenses could not be obtained are still in New York warehouses, though authority to take them over was granted the government recently by Congress.

At the dinner Colonel H. A. Toulmin, Jr., speaking on "Organizing for War," advocated a separate Air Corps and a Coordinator of National Defense. In training apprentices, Monarch Machine Tool Co. uses the functional method of teaching, said D. H. McKellar, Monarch's supervisor of training. The principle of doing the job is taught rather than the operation of specific machines.

New machines must be created and produced to build the products which society will invent and demand 10 years hence, said A. G. Bryant, president Bryant Machinery & Engineering Co., Chicago, and past president of the association. Captain R. O. Brownfield, Wright Field, discussed the place of the Air Corps in national defense. E. B. Newill, assistant general manager, Frigidaire, made a talk on "Heat and Cold". John Sauer, Jr., Peninsular Machinery Co., Detroit, the retiring president, presided at all sessions.

New Officers are: President: F. B. Scott, Jr., Syracuse Supply Co., Syracuse, N. Y.; Vice-President: Albert M. Stedfast, Stedfast & Roulston, Inc., Boston, Mass.; Secretary-Treasurer: F. W. Schiefer, F. W. Schiefer Machinery Co., Rochester, N. Y.; Directors for 3 years: Edward A. Lynch, Edward A. Lynch Machinery Co., Philadelphia, Pa.; T. C. Stephens, Robert R. Stephens Machinery Co., St. Louis, Mo.; and A. G. Wigglesworth, A. G. Wigglesworth Machinery Co., Cambridge, Mass.

INSIDE DETROIT

Manufacture of aircraft parts is auto industry's No. 1 job; Knudsen places responsibility upon industry to see that its resources are utilized to best advantage in supplying aviation

BY RUPERT LE GRAND, DETROIT EDITOR

DETROIT—W. S. Knudsen has a way of cutting straight to the heart of a problem and making other people like it. Until auto leaders attending the New York Auto Show heard Mr Knudsen say at a luncheon that they had better "take another look," the general attitude had been that motor-car production was the industry's principal concern for 1941 Lack of standardization of plane designs gave rise to the convenient contention that manufacture of aircraft parts was not feasible in mass-production shops

Mr. Knudsen followed up the attack that afternoon in closed session Besides showing that two bomber designs are standardized, and other plane types may be, his remarks led to a complete reversal in attitude by his hearers Now the industry sees aircraft parts as its "No 1 job," and promises to do its utmost in putting all resources of skill, equipment and needed plant capacity behind the aircraft procurement program It will have to do some fast stepping to prevent aviation motor output from running ahead of plane assemblies by the middle of 1941

In attempting to continue the "American way," Mr Knudsen has placed full responsibility upon th auto industry to see that its resources and those of its allied industries shall be utilized to the best advantage toward supplying the aviation industry, meanwhile maintaining car and truck production The suspicion exists, however, in the minds of observers close to government that automobile production will have to take second place if the needs of aviation are not adequately met

Co-ordination Necessary

In a recent meeting Mr Knudsen further outlined his ideas to a committee representing the auto plants, parts plants and the tool and die industry This committee was broad-gage in its representation, and was not restricted to members of the three trade associations The next step is for this committee to meet with one from the aviation industry After an exchange of ideas, both sides can get down to working out the problems of what must be made and where it shall be made The program is too large for a mere handing out of parts prints and letting everybody pick and choose as he sees fit

While it is the intention to have this committee function in a democratic manner, there is little doubt that it must be able to exercise wide powers To some extent the orders from Washington for eight billions of national-defense contracts have placed excessive loads upon certain companies and failed to draw other just-as-well-equipped concerns into the program Some re-allocation of effort is indicated if all phases of the national defense program are to keep in step Perhaps some decentralization in authority of the National Defense Commission itself will occur Business leaders now in Washington may soon return home to take an active part in the national-defense programs of their industries

Development Uncertain

Nobody can foretell accurately at this stage just how the aircraft parts program will develop When the work is first assigned to auto, body and parts plants, it is likely that only individual parts or small sub-assemblies will be manufactured for shipment to the plane plants for assembly Later on the exigencies of mass production may demand that larger sub-assemblies be produced by a principal sub-contractor who may or may not be supplied by a number of parts makers Entire wings are now being considered The whole idea of the program is to make use of the skill and resources of the automobile industry without involving procurement of much equipment from the already overburdened machine tool industry

Sheet metal parts for wings, controls and fuselages of airplanes are indicated as the principal contribution of the auto industry But the tools, dies, fixtures and jigs and gages for these parts must be designed and made after contracts are awarded While the complexity of the tooling may not reach that found in many automotive operations, those familiar with aircraft work say that several months will be required to design and make the tools after jobs are assigned by the committee and approved by the government It is a fair assumption, therefore that the actual "pieces" wanted by Mr. Knudsen can not commence to flow to plane plants much before next March at least, and perhaps not before summer

PLAN NO CHANGE FOR AUTOS

DETROIT—In the interest of National Defense, the Automobile Manufacturers Association has gone on record against mechanical changes in 1942 models that will require purchase of equipment next Spring from hard-pressed machine tool industry. Some revisions in fender, front-end, trim and hardware can be expected in 1942 models Their extent will depend upon conditions in the tool and die industry which will be busy next Spring on the aircraft-parts program If the emergency continues for two or three years more, the automobile industry will undoubtedly spend huge sums for new equipment with which to bring their products mechanically up to date at that time

Commercial aviation manufacturing facilities of Vultee Aircraft, Inc. will be concentrated in the Detroit area to be near suppliers of parts and local sources of skill and mass production manufacture Two months ago Vultee acquired Stinson Aircraft Corp which last year moved its commercial and newly developed military lines to a new plant at Nashville Now the commercial business is being returned to the Wayne Mich plant

Richard W Millar president, and Don I Carroll vice-president in charge of production for Vultee, told AMERICAN MACHINIST that re-opening of the Wayne plant marks the beginning of a long range program by Vultee to develop mass-production manufacture of commercial aviation as the mainstay of its business in the future Production of the Stinson 105 will be stepped up to one hundred per month in the early part of next year, and the larger Reliant will be built in lesser quantities A broad research and development program is underway to widen the scope of the commercial market served, particularly lower-priced pleasure craft

The Wayne plant will be opened November 1, with six hundred to be employed by the year end It is hoped to step up operations sufficiently next year to employ over two thousand Twenty thousand square feet are being added initially to the Wayne plant $500,000 will be spent, half for machinery Barclay-Grow Corp., Detroit, maker of small planes, has been purchased and its personnel will form the nucleus of the Stinson Division's working force. Personnel of the Stinson Division will include Karl Kalpwasser, works manager; A F Fontaine, chief engineer, and R E Osborn, director of research.

The Nashville plant will be known as the Nashville Division of Vultee and is undergoing expansion.

Philip P. Gott Addresses Gear Manufacturers At Skytop Meeting; New Standards Adopted

SKYTOP, PA. — Trade associations can be of material help in promoting the program of national defense by cooperation between their technical committees and the military agencies, according to Philip P. Gott, of the Chamber of Commerce of the United States. Mr. Gott addressed the 23rd semi-annual meeting of the American Gear Manufacturers Association, held at Skytop, Pa., October 14-16. He pointed out that engineering specifications originating with the association would be found useful in the procurement of armament and other defense items.

Business and technical sessions during the three-day meeting were presided over by A.G.M.A. President U. Seth Eberhardt, Newark Gear Cutting Machine Co., and Vice-President Walter P. Schmitter, Falk Corporation.

The advantages of credit unions were stressed in an address by E. S. Sawtelle, Tool Steel Gear & Pinion Co. Mr. Sawtelle told of the progress the credit union plan had made in his concern and its advantages to the employee in need of financial assistance.

Bearing Selection Described

The problem of the gear drive designer in selecting from a wide variety of bearings was described by S. L. Crawshaw, Westinghouse Electric & Mfg. Co. This speaker outlined the characteristics of sleeve bearings and the various types of anti-friction bearings as applied to the commonly used gear drives. His talk was illustrated by views of installations that have a record of satisfactory performance.

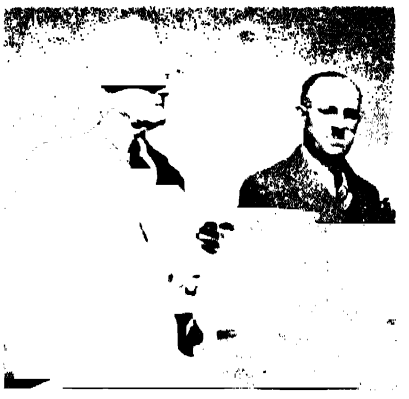
Motion characteristics of silent chains was the subject of a talk by H. A. McAninch, Link-Belt Co. Mr. McAninch told of the irrelevant motions in the operation of silent chains and how they could be minimized by the use of a generated tooth.

B. A. Miller, Cramp Brass & Iron Foundries Co., described the characteristics of two metals which he believed to have application in worm gearing. One of these, a copper-tin-nickel-zinc alloy, is subject to heat-treatment and age hardening to give desirable strength and ductility characteristics. The second, a copper-silicon-iron alloy, has an advantage in that it does not depend on imported materials.

This meeting of the A.G.M.A. witnessed marked progress in the work of the standardization committees coming under the general supervision of T. R. Rideout, Westinghouse Electric & Mfg. Co. The committee on the lubrication of gears of which H. A. McConville, General Electric Co., is chairman, offered a standard which was accepted as recommended practice. The committee headed by Granger Davenport, Gould & Eberhardt Co., completed its work on inspection tolerances of spur and helical gears which became a proposed recommended practice. J. H. Flagg, Watson-Flagg Co., chairman of the gearmotor committee, offered a proposed recommended practice on the ratings of concentric and parallel-shaft gearmotors.

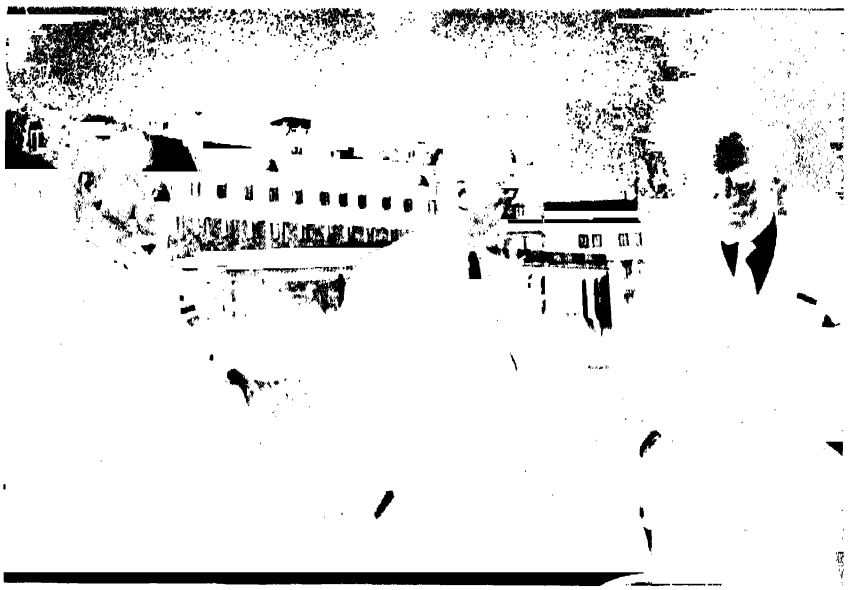


Prof. F. Mickle, U. of Michigan, (left) and R. S. Marthens, AGMA treasurer, enjoy a moment of recreation at Skytop meeting



A. A. Ross, General Electric Co., (above, left) and L. D. Martin, Eastman Kodak Co., attended AGMA meeting, commented on papers. At right, D. T. Hamilton, Fellows Gear Shaper Co., finds time to take some candid pictures and stroll about the grounds





AGMA President, U. Seth Eberhardt, Newark Gear Cutting Machine Co., H. H. Kerr, Boston Gear Works, and F. B. Drake, Johnson Gear Co., (left to right) relax between sessions, makes plans for the future

Differences in Production Methods Discussed At A.S.M.E. Meeting on Shell Manufacture

CINCINNATI—Several hundred representatives of metal-working plants, U. S. Army ordnance officers, and representatives of the machine tool industry attended the A.S.M.E. meeting on manufacture of shell held here Oct. 16 and 17 under the auspices of the Army Ordnance Association, A. S. M.E. Ammunition Group, Machine Shop Practice and Metals Engineering Divisions and Cincinnati Section of A.S.M.E.

With Col. James L. Walsh, chairman, A.S.M.E. Committee on National Defense, presiding, the first session was given over to a discussion of shell steel specifications and furnace equipment suitable for heating shell billets for forging. This session was opened by Edward A. Muller, president, the King Machine Tool Co., and civilian chief of the Cincinnati Ordnance District. In his introductory remarks, Mr. Muller paid tribute to manufacturers in the metal-working industry who are showing much determination to supply needed products as rapidly as possible. He also complimented the Army Ordnance Department on the work that has been done in preparing specifications for needed material, particularly with respect to shell, which must be safe to handle, accurate in flight and efficient in fragmentation when it reaches the target. Because of the vast quantity of shell that would be required in the event of hostilities, the production problems involved probably are more important now than those involved in the manufacture of guns to fire these shell.

Ordnance shell steel specifications were discussed in some detail by Lt.-Col. Miles W. Kresge, Assistant to Chief of Ordnance, U. S Army. He pointed out that shell is the product of essential compromises between requirements of the Army artillery divisions for shell that will function properly, and the requirements of steel suppliers, forgers, and metal-workers for a product which can be manufactured efficiently in large quantities. Free-machining, high sulphur, high manganese steels now are being used for shell so that the product can be machined rapidly and accurately. These steels will be used until a shortage of manganese forces a change in specifications. He also said that the Ordnance Department is open-minded on the subject of specifications, and will consider recommendations for changes where these will result in better manufacturing efficiency without reduction in quality of the product.



Interested listeners at all of the sessions were Sol Einstein, (left) vice-president, Cincinnati Milling Machine Co., and H. J. Wills, Carborundum Co. Mr. Wills read a paper on the classification of surface finish of shell at one of the morning meetings



James R. Weaver, Westinghouse, and Charles Meier, general manager of Acme Machine Tool Co., found time for a couple of stories while attending the A.S.T.E. meeting on shell production

The suitability of batch type, straight line continuous pusher type, and rotary hearth furnaces for heating shell billets were considered in an informative paper presented by Professor W. Trinks of Carnegie Institute of Technology. He pointed out that all three types of furnace are adaptable for this work, but that they each have certain limitations In all three types it is necessary that the rate of heating and the maximum temperature be controlled carefully so that the edges and corners will not be melted to form slag on the house of the furnace The furnace builders association has suggested a heating rate of 60 lb per sq.ft. per hr. with a maximum furnace temperature of 2,300 F. for the heating of these billets. Control of furnace atmosphere to reduce scaling is important, but the formation of a slight amount of scale is to be expected in all three types of furnace. With regard to temperature and atmosphere controls, Prof. Trinks pointed out that automatic controls are worse than hand control when they are not supervised properly.



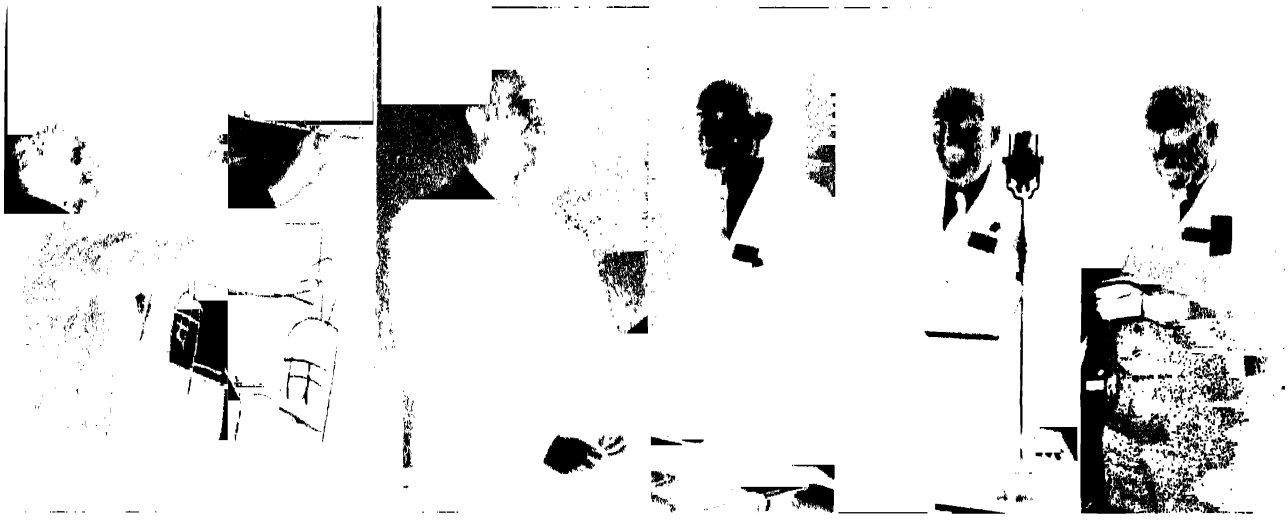
Edward A. Muller, (left) president, King Machine Tool Co., and chief of Cincinnati Ordnance District, was one of the first speakers. He is shown here with Warner Seely, Warner & Swasey Co

In the discussion of Prof. Trinks' paper, Alan Dauch, George J. Hagan Company, pointed out that heating time in rotary hearth furnaces is about 60 per cent of that required in pusher type or batch type furnaces for the same work. Maintenance cost with rotary hearth furnaces is slightly higher than with other types, because it is a mechanical unit operating at high temperatures. This high maintenance cost, however, is offset by higher production rates. The discussion also brought out the fact that pusher type furnaces have a number of advantages, in that they are simple and economical to operate. Susceptibility to scaling and slag formation is highest in the rotary furnace and lowest in the batch type unit.

Efficient Arms Needed

In his talk at the luncheon Wednesday, J. B. Doan, president of the Cincinnati chapter of the Army Ordnance Association, and Chairman of the Board of the American Tool Works Company, pointed out that while trained men are necessary in modern warfare, they are not enough We must have efficient arms in large quantities. He further stated that he believed that the hope of our democracy is to be so thoroughly prepared that statements of our leaders will not be taken as bluff, but will be backed up with a well-equipped, well-trained army

The Wednesday afternoon session was given over to a discussion of shell forging equipment, with Robert T. Kent, production engineer, Ordnance Dept., U. S. Army, and George F Schranz, general manager, Bald-



Active Participants—*Many A.S.M.E. members took active part in the discussion held during the meeting on the Manufacture of Shell. Above (left to right) Professor W. Trinks, Carnegie Institute of Technology, discusses the adaptability of various furnaces for heating shell billets. Lucien I. Yeomans talks on the application of shell machining equipment. Lt. Col. Miles W. Kresge, Ordnance Department, U. S. Army, spoke about ordnance shell steel specifications. Professor Frank Macconochie, University of Virginia, reported on a recent extensive survey of present day shell forging equipment. H. N. Anderson, The Hill Acme Co., took part in the discussion of shell forging methods. He recommended the use of special handling equipment to speed up forging of large shell by upset method*

win Southwark Div., Baldwin Locomotive Company, presiding. In his analysis of shell forging equipment, Frank Macconochie, professor of mechanical engineering, University of Virginia, pointed out that availability and speed of production are essentials in the shell program. Both the upsetting and the pierce and draw methods of producing shell forgings will be used, as well as a number of special shell forging machines which have been made available to American manufacturers. The relative merits of various types of equipment are not as important as the job of getting the shell program under way.

480 Shells Per Hour

Two new methods of forging shell were announced during this session A. Waltman of Clearing Machine Corporation said that his company is building an automatic machine which should produce about 480 shell per hour, delivering them on a conveyor This unit comprises a furnace and forging machine connected together, so that the only labor required is for loading the furnace. The first unit of this design will be ready for demonstration soon, according to Mr. Waltman. Also, in his paper on the flow of metal during the forging of shell, Mr. M. D. Stone, United Engineering and Foundry Company, announced development of a new hydraulic forging press by the Dominion Engineering Works of Canada, an associate of United Engineering and Foundry Company, which makes a complete shell forging in one operation. The second operation now done in a draw press is eliminated with this machine.

A shell machine capable of turning a shell a minute, designed for the Army by the machine tool industry was mentioned in his talk on cooperation between the government and the machine tool builder by Tell Berna, general manager of the Machine Tool Builders' Association, during the Thursday morning session. Mr. Berna announced that the Studebaker Corporation has built the first of these machines and has it in operation on a continuous life test According to him, the reason for designing these machines is that in the event of war the army will have tested designs which could be followed by any manufacturer equipped for this type of production. This will insure a broad source of supply and enable the Army to get shell in large volume without expensive delay.



E. P. Blanchard, sales manager, Bullard Co.; J. B. Doan, chairman of the board, American Tool Works Co.; and August H. Tuechter, president, Cincinnati Bickford Tool Co., found mutual problems to talk over while at the meeting. Mr. Doan is president of the Cincinnati chapter, Army Ordnance Association

Stressing the part played by machine tools in National Defense, Mr. Berna stated that the industry already has doubled its output during the past twelve months, and probably will expand considerably during the next year. He pointed out that one of the major bottlenecks in defense production is the lack of trained men. To quote Mr. Berna, "Machine tools are only one element in national defense production, many other types of machinery are also needed. Plants need to be built, men need to be trained, large numbers of gages, jigs and fixtures will be required. Methods of manufacture must be checked and revised. And then all of these elements must be coordinated before large scale production actually gets under way. The machine tool industry is confident that it will be able to produce the machine tools required just as rapidly as plants will be ready for their installation and the men ready for their operation."

Simple Machines Advocated

Lucien I. Yeomans discussed the controversy between the two schools of shop procedure, in which one advocates the reduction of operations to their lowest terms and the use of simple machines, while the other advocates putting as many operations as possible upon one machine, with the requirement of a skilled operator not easily trained. He strongly advocated the use of simple machines for single operations, so that plants which will manufacture shell can get under way without first having to go through an extensive training period.

Japan Plans to Produce Needed Tools; U. S. Patentees Endangered

TOKYO—Plans to make Japan's engineering industries self sufficient in machine tools within three years were recently discussed at a government-sponsored conference The result: machine tools which heretofore have been imported will be made in Japan Officials hinted that if "encouragement" measures should fail to produce the desired results, the General National Mobilization Law will be invoked under which orders may be placed with manufacturers regardless of previous commitments Private plants may be expropriated by the government as a last resort

Government representatives indicate that foreign patents will be respected in the drive for Japanese manufacture of machine tools However, patented machine tools which have not been imported or manufactured in Japan for three successive years may be compulsorily licensed under the Patent Law in Japan This provision has much significance for American machine tool manufacturers whose designs are protected by Japanese patents As long as manufacturers are able to export tools to Japan infringement of patents is ruled out by law However, if tools should become unavailable in Japan (as they have, due to American export restrictions) the American patentees are required to offer the patent for sale "on reasonable terms" so as to avoid invalidation or expropriation

NAMES in the NEWS

James H Chasmar, former works manager of the Remington Arms Co, Bridgeport, Conn, has been placed in charge of all work Wm C Ashcroft succeeds Mr Chasmar as works manager and A E Buchanan, Jr, technical director of the company, has been named assistant works manager

Dr Claude L Clark, formerly of the department of engineering research of the University of Michigan, has joined the metallurgical staff of the steel and tube division of the Timken Roller Bearing Co at Canton, Ohio as metallurgical development engineer During the past ten years at the University of Michigan Dr Clark has conducted research studies of the properties of metals at elevated temperatures

Rear Admiral Wm G DuBose, who has retired from the United States Navy after serving more than 45 years, including service as the Navy's chief constructor from 1937 to 1939, has been elected chairman of the executive committee and a director of Cramp Shipbuilding Co In his new post, Admiral DuBose will take an active part in the reopening of the shipyard and in the construction of more than $100,000,000 of naval cruisers for which an order has been placed with the company

Charles R Pritchard and Ralph J Brown have been appointed vice-presidents of the General Electric Supply Corp, Bridgeport, Conn

D C Peterson formerly vice-president in charge of manufacture of the Buda Co, has been appointed works manager of the Superior Engine Division of the National Supply Co, Toledo, Ohio In 1934 he was affiliated with the Continental Can Co, New York N Y

Captain S C McDowell, U S Navy, retired, was appointed new president and general manager of the Enterprise Foundry Co, San Francisco Charles Hoehn, who had been president of the concern was named chairman of the board

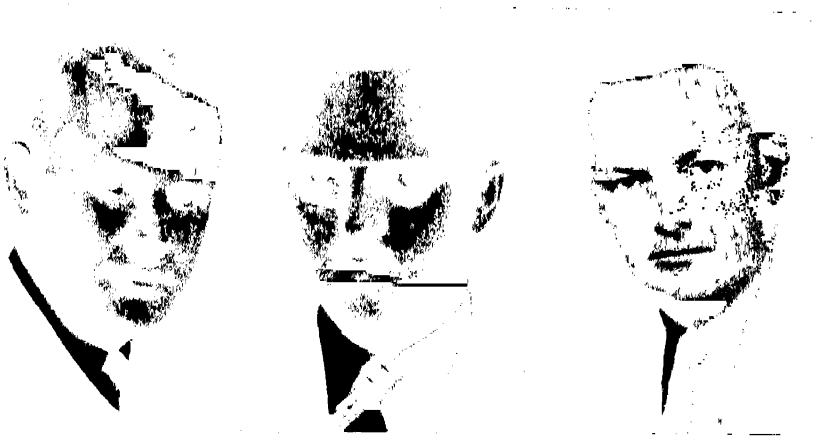
Oliver T Osborne, former general manager of the Locke Steel Chain Co, Bridgeport Conn, has been elected president Mr Osborne has been with the company 28 years and succeeds D Walter Haggerty, who becomes chairman of the board Other newly elected officers include Sylvanus D Locke, vice-president and treasurer, F S McDaniel secretary

Eugene R Perry has been promoted to manager of engineering and superintendent of the Micarta works of the Westinghouse Electric & Mfg Co at Trafford, Pa Mr Perry has been associated with Westinghouse since 1929

E W Ritter, former general manager of radio tube manufacturing, has been appointed vice-president in charge of all manufacturing and production engineering of the RCA Mfg. Co H L Sommerer, former manager of manufacturing has been appointed assistant to Mr Ritter

Works Manager

New V-Presidents at G-E Supply Corp.



D. C PETERSON R. J. BROWN C. R. PRITCHARD

PLANT EXPANSION

American Steel and Wire Co, Worcester, Mass, subsidiary of United States Steel Corp, will construct four additions to the company's South Works The project, to be completed within 20 months, will provide modern, centralized facilities capable of meeting the needs of the New England market

Boeing Airplane Co will expand its plants at Seattle, Wash, and Wichita, Kan, to a total of 74 acres, five times their area of a year ago Of the 1,600,000 sq ft to be added, two-thirds will be at Seattle and one-third at Wichita

General Electric Co has begun a $50,000,000 expansion program to supply National Defense needs All plants equipment, and defense materials will be increased

R Hoe & Co, Inc New York, N Y will erect a new $40 000 welding plant for the manufacture of recoils for guns and gun parts The new plant will increase the total manufacturing area of the company to approximately 190,000 sq ft

Martin Electric Co, Detroit, manufacturers of resistance welding transformers is completing an addition to its plant The expansion doubles the manufacturing floor space and will add more than 100 per cent to production capacity of the company

Carboloy Co, Inc, Detroit, is opening a branch office in Los Angeles, and will carry a complete stock of



Cited —*George H Buchei, president, Westinghouse Electric & Mfg Co, (left) receives a 30 year service emblem, presented by A. W Robertson, chairman of the Co More than 21,000 other employes, who have been with the Co. 10 or more years, received similar service awards*

standard carboloy tools The offices will be in charge of J W Doody and Ray D Mack

American Magnesium Corp New York, N Y is tripling its fabricated magnesium output to supply the demands of National Defense A new die-casting plant has just been erected and equipped at Garwood N J

Bendix Aviation Corp Bendix N J, has purchased the Atwater Kent Mfg Company's plant No 6 at Philadelphia After details of the purchase have been approved the plant will be prepared for operation and it is expected that between 7 000 and 10,000 men will be employed

Bell Aircraft Corporation's new $1,050,000 aircraft assembly plant at Niagara Falls, N Y is scheduled to be completed by Feb 1941

The new building will provide approximately 300,000 sq ft of floor space A force estimated at 3 000 men employed on three 8-hour shifts will assemble Airacobra type fighting planes for the United States Army

Aluminum Co of America will erect a large addition to its Edgewater, N J plant The new factory will be 8 stories in height and will measure 141 by 81 ft This project is part of the company's $150 000 000 expansion program

Westinghouse Electric & Mfg Co will spend $500,000 in expanding facilities of its lighting divisions at Cleveland, Ohio The expansion involves four new buildings and operating equipment, and is scheduled to be completed February 1

BUSINESS ITEMS

National Cylinder Gas Co Chicago Ill, will take over the distribution of the "Rego" line of gas welding and cutting equipment manufactured by Bastian-Blessing, also of Chicago

Kitson Co, Philadelphia, Pa, has acquired the exclusive rights for the manufacture and distribution of Oman belt-lubricating bearing metal Since the Kitson Co was founded in 1893 it has specialized in the manufacture of brass goods for the water gas, and plumbing industry

Willard Equipment Ltd Vancouver, B C has been appointed representative in British Columbia and Alberta for the Mercury Mfg Co, Chicago, Ill, a leading manufacturer of materials handling equipment

H A Smith Machinery Co, Syracuse N Y has been appointed a distributor for Sullivan Machinery Co, Michigan City Ind The Sullivan line of air and gas compressors for industrial uses will be distributed

OBITUARIES

Benedict Shubart western sales representative Link-Belt Co Chicago died recently at the age of 64

Arthur W Graham president and treasurer of the Graham Mfg Co Providence R I recently died of a heart attack at the age of 67 At one time Mr Graham was connected with the American Locomotive Co and later with the Builders Iron Foundry

Ralph R Hull 61 former secretary-treasurer of the Houde Engineering Corp, and one-time head of the construction department of the Lackawanna Steel Co died recently at his home in Buffalo after an illness of several months

Morrison Mills eastern district manager of the Construction Equipment Div of the Chain Belt Co Milwaukee, died recently Mr Mills was Service Manager of the Construction Equipment Div of the company from 1931 to 1937

Carl Wentorf plant superintendent of the West Bend Aluminum Co, West Bend Wis died recently at the age of 67 Mr Wentorf helped found the West Bend firm 29 years ago

H H Timken Sr co-founder of the Timken Roller Bearing Co, Canton, Ohio died of pneumonia two

Dies at 72



H H TIMKEN, SR

weeks ago after a short illness Mr Timken who was 72 years old was chairman of the board at the time of his death With his father and brother in 1898 Mr Timken helped found the company He has watched the organization grow from one plant to plants in Canton Columbus Wooster and Mount Vernon all in Ohio and in which more than 10 000 persons are employed Mr Timken was president of the company for 23 years and chairman for 12 His father developed the Timken Roller bearing which has played a major role in the development of the automobile

Noble J Ross one of the founders of the Beloit Iron Works in 1885, is dead at the age of 86 At the time of his retirement 15 years ago Mr Ross was vice-president of the iron works

MEETINGS

American Management Association Annual conference Cleveland Hotel Cleveland, Ohio, Nov 12 and 13

American Society of Mechanical Engineers Annual convention New York, N Y Dec 2–5

National Exposition of Power and Mechanical Engineering Grand Central Palace New York, N Y Dec 2–5

Society of Automotive Engineers Annual meeting, and engineering display Book-Cadillac Hotel, Detroit Mich, Jan 6–10, 1941

Society of Automotive Engineers National Fuels and Lubricants meeting Hotel Mayo, Tulsa, Okla Nov 7–8

Motor & Equipment Manufacturers Association Annual meeting. Blackstone Hotel, Chicago, Ill Dec 10

SHOP EQUIPMENT NEWS

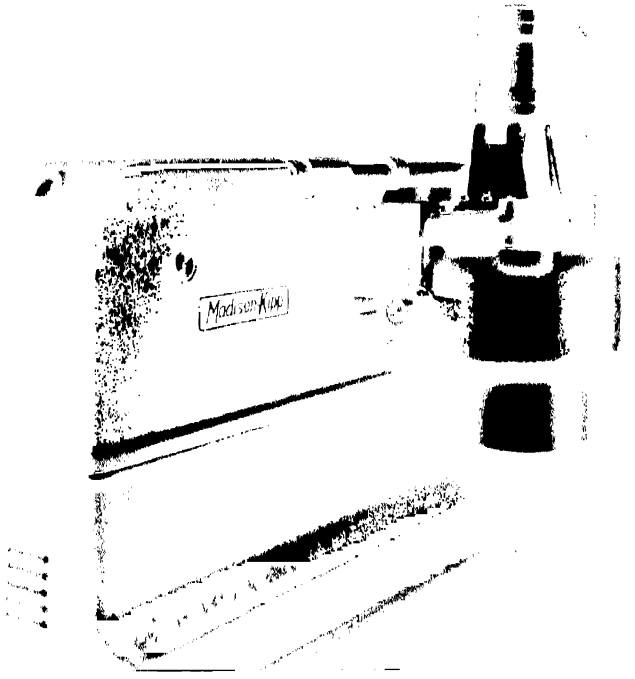
'Kippcaster" Die-Casting Machine Designed for Handling Zinc Alloys

Madison-Kipp Corp, Madison, Wis, has developed the Model No. 500 "Giant Kippcaster" especially for the die-casting of zinc alloys. This new model is about twice as large as the company's previous standard model, with a weight of about four times that of the standard to provide added strength needed for handling substantially larger parts

The new model "Kippcaster" utilizes a combination of hydraulic and air operation. Die-head rams operate hydraulically through a special toggle arrangement, which is actuated by a hydraulic cylinder. The standard hydraulic system is a Vickers combination pump driven by a 1½ hp. 1,200 r.p.m. motor Standard die head measures 8 x 10 in, but clearance is provided so that larger dies can be used. Both stationary and movable dies may be of two standard thicknesses—either 3 or 4 in.

Machine stroke is 8½ in. with standard cylinders and plungers. Over 1,800 lb. pressure is exerted on the metal with 100 lb. air pressure. Gooseneck with standard plunger has a capacity for shooting a 3½ lb. casting. Pot capacity is 200 lb of zinc alloy.

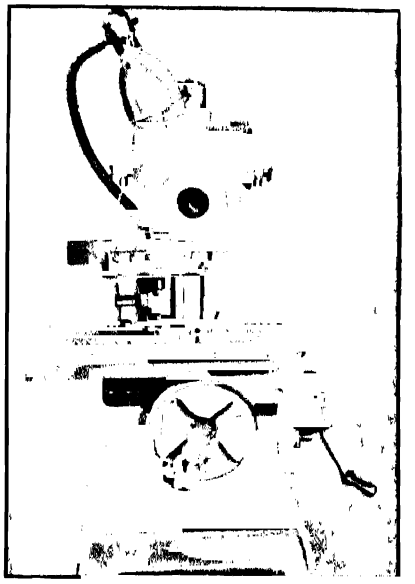
Main castings of the machine are made of high strength Meehanite A iron, as are the metal pot and gooseneck. Power parts are made of heavy cast steel. Length of the machine is 8 ft 1 in, width is 3 ft. 8 in., and height is 6 ft 2 in Weight is approximately 6,500 lb



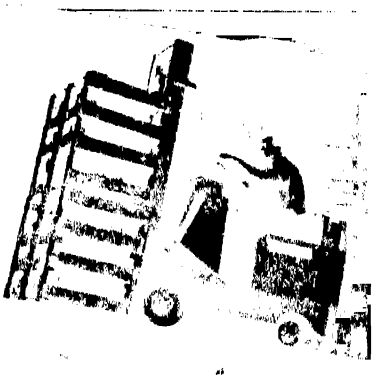
Chip-Breaker Grinder Announced by Carboloy

A low-priced grinder for grinding chip-breakers in carbide tools has been announced by Carboloy Co., 11149 E. Eight Mile Rd, Detroit, Mich With this grinder, exact forms of chip-breakers determined as ideal for any given operation can be duplicated quickly when the tool is re-ground. The tool is clamped in a toolholder mounted on a universally adjustable fixture table fitted with three protractors, to permit adjusting to correct setting in all directions with minimum effort

The tool is then moved under the wheel to a distance corresponding to the chip-breaker width and the wheel is fed down while feeding the table back and forth The wheel-feed is also provided with graduations so that chip-breakers can be ground to exact depth. Resinoid diamond wheels of 100 grit are recommended Grinder



is designed for use with tools up to 1¼ in wide. Operation is through a 110 volt, 60 cycle, ¼-hp. ball-bearing motor equipped with reversing switch.



Towmotor Lift Truck Handles 3,000-Lb. Load

Towmotor Co., 1264 E. 152nd St., Cleveland, Ohio, has developed a small lift truck especially for handling 1,000- to 3,000-lb. loads. Built on a 40-in. wheelbase, this Model No. LT-40 truck weighs in the neighborhood of 3,500 lb., has a turning radius of 68 in., an over-all lift of 35 in., and a length without forks of 70 in. Interchangeable attachments — forks, rams, scoops, flat plates, special loading devices—fit the unit for a wide variety of materials-handling operations.

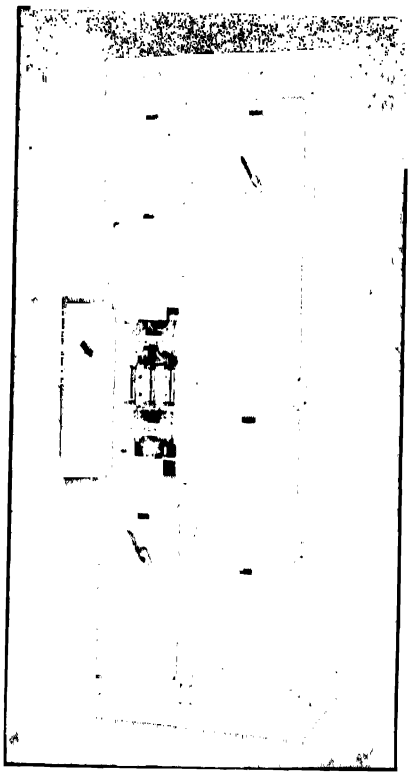
Powered by a 22-hp. four-cylinder gas engine, equipped with degasser and governor, the truck travels at

speeds from 1 to 10 m.p.h. Two speeds forward and two in reverse are achieved by a special transmission having only four gear elements. A special hydraulic lifting and tilting system enables the unit to lift and stack its rated load accurately to heights of 7, 9 and 11 ft. at approximately 40 ft. per min. Design improvements include entire motor assembly and battery instantly accessible by lifting driver's seat; specially designed transmission case which permits removal of air-ventilated clutch plate without disturbing transmission; front (driving) axle housing designed as an integral part of the frame structure.

Cutler-Hammer "Unitrol" Permits Flexible Installation

The "Unitrol" system of sectionalized motor control developed by Cutler-Hammer, Inc, 205 N. 12th St., Milwaukee, Wis., permits all needed types of control devices to be organized in locker-like motor control centers instead of the usual pillar-and-post method of mounting. Standardized construction allows quick building up of any control center to meet present requirements. Future changes are quickly and easily made by adding or removing sections, or by replacing unit controllers.

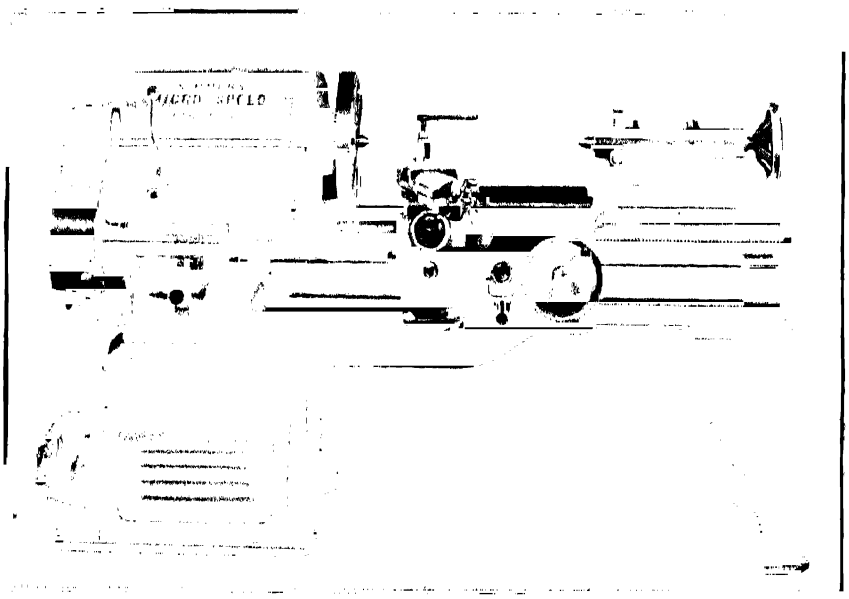
Standard motor control units are mounted in standardized cubicle sections which are made in 32 sizes,



8 widths and 4 heights for mounting any combination of units. Standard units can accommodate controllers, disconnect switches and accessories as required. Control units can be mounted in both front and rear of the section, giving double-sided construction.

"Micro-Speed" Drive of Simmons Gap Bed Lathe Changes Spindle Speed Without Gears or Clutches

Maximum flexibility of spindle speeds without gears or clutches is achieved through the use of the "Micro-Speed" drive on a new line of gap bed lathes developed by Simmons Machine Tool Corp., Albany, N. Y. This drive, installed in the cabinet type leg, provides a virtually unlimited variation of spindle speeds by finger-tip control. Only a slight twist of the handwheel on the headstock gives a wide range of speeds. Change is instantaneous.



Removable gap blocks in the bed permit greater swing through the gap. The lathe is equipped with Timken precision tapered roller bearings on the main spindle, which is driven through V-belts. Rigid bed is of semi-steel. Carriage is so arranged to bring the compound rest close to the face plate. All gears in every feed mechanism are of forged steel, with accurately cut teeth. To preserve accuracy in screw cutting, a separate feed rod is provided.

This lathe is built in 16–25 in. and 18–27 in. sizes. Specifications, respectively: swing over ways, 18 and 19 in.; swing through gap, 25½ and 27¼ in.; total width of gap, 14 and 14 in.; width of each gap block, 7 in.; swing over carriage, 12 and 13 in.; distance between centers on 6-ft. bed, 36 and 36 in.; weight, 3,500 and 3,700 lb.

Intermittent Scrap Cutter Also Trims Finished Parts

Punch press scrap can be cut to predetermined lengths and finished products cut to length with the dual purpose intermittent scrap cutter developed by F. J. Littell Machine Co., 4169 Ravenswood Ave., Chicago, Ill. This cutter operates at any given



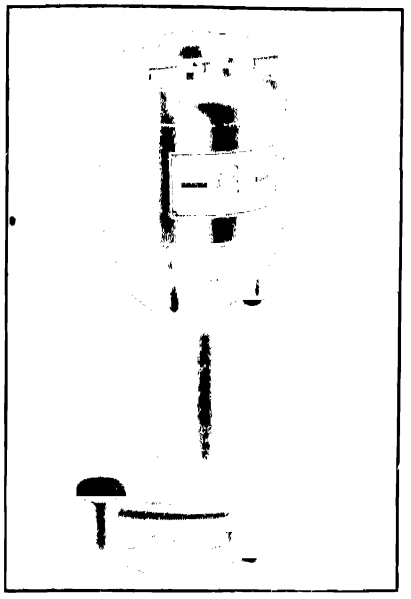
number of strokes of the press. In normal operating position the cutter blades are held open by spring. A gag or blocker unit is built into the rear scrap-cutter connection, operated by a solenoid which moves the gag to the cutting position. Solenoid is connected to the controlling unit which consists of a ratchet (which may have any number of teeth), a driving mechanism for operating the ratchet at one or more teeth per stroke of the press, and a switch operated by trip lugs on the ratchet gear. In operation the lugs trip the switch every so many strokes of the press.

"Coolflo" Coolant Pump Features Compact Design

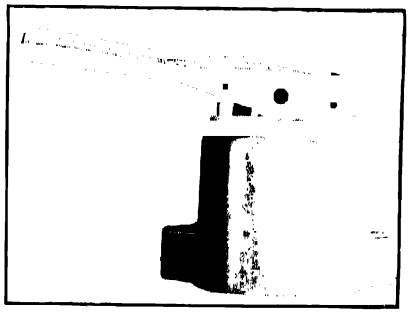
Warren Steam Pump Co., Warren, Mass., has developed the "Coolflo" coolant pump especially for machine

tool application. Both submerged and outside mounting types are made.

Unit is extremely compact, and will circulate coolant containing dirt, chips and abrasives with minimum wear and without clogging. Casing



and suction head are made of high-grade cast iron. Hard bronze impeller is of the open type, hydraulically balanced. One-piece shaft is of heavy stainless steel. A totally inclosed 220, 440 or 550 volt motor is built into the unit.

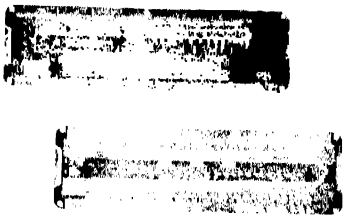


Four Way Valve Controls Two Double-Acting Cylinders

C. B. Hunt & Son, 1851 E. Pershing St., Salem, Ohio, has developed a double four-way hand-operated air valve suitable for controlling two individual double-acting air cylinders. This valve is said to be suitable for control of air-operated clamps, fixtures, knives and other devices where it is necessary to have one point of control for two cylinders that lead and lag one another in their respective actions.

Hobbing-Time Calculator Offered by Barber-Colman

A slide rule designed to simplify the calculation of hobbing time offered by Barber-Colman Co., Rockford, Ill., permits calculation of hob approach for spur gears, spline shafts and other straight forms. Hobbing time is easily calculated by setting the two slides



on the reverse side in the order indicated The rule contains all standard hob speeds found on Barber-Colman machines. By interpolation the calculator can also be used for determining hobbing time on other makes of machines.



Hancock Valve Parts Now Are Superfinished

Life of valve seats and disks is claimed to be increased twelve-fold by the use of superfinishing on the "500 Brinell" line of valves offered by Hancock Valve Div. of Manning, Maxwell & Moore, Inc., Bridgeport, Conn. Specially developed superfinishing machines are used for the newly adopted process.

'Gyromatic" Vertical Automatic Screw Machine Requires Minimum Floor Space for Installation

Built by Tavannes Machine Co. of Switzerland and distributed in the United States by Cosa Oversea Trading Corp., 5000-4 Chrysler Bldg., New York, N. Y., the "Gyromatic" vertical automatic screw machine occupies only a fraction of the floor space needed by conventional horizontal types Other advantages accruing from the vertical design are claimed to include reduction of noise, virtual elimination of vibration, greater convenience and increased safety.

Feed cams of the six longitudinal and six cross slides are located around the base, so that diameters and lengths of parts can be adjusted to within 0.001 in. while the machine is in operation. All slides are simple toolposts taking usual turret lathe tools. They are actuated by easily interchangeable independent cams. Each cam can be used for many strokes through a system of levers. The six boring, tapping and reaming spindles coming from below opposite the work spindles allow chips to drop out of holes, making deep-hole drilling easier. Design permits constant checking of all tooling through plastic windows in the machine enclosure, not shown in the illustration.

Adjustable stops control down feed of bars. Spindle turret revolves on ball and thrust bearings, and is locked on a diameter twice as large as the spindle circle diameter. No chips, cutting oil or dirt can fall on

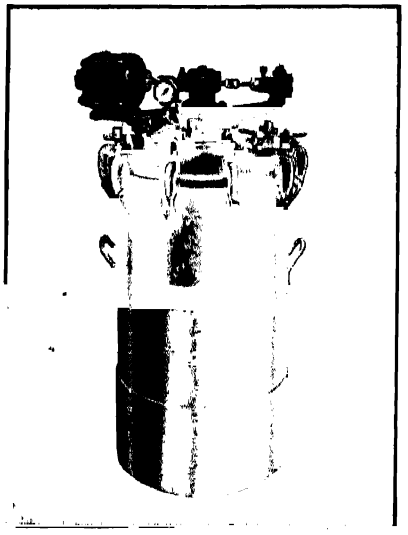


the spindle head, which is high above the cutting tools.

All three current models of the "Gyromatic" have six spindles. Capacities for bar work are 1, 1⅝ and 2¼ in.; for chuck work, 4, 5½ and 7½ in. If soft metals are to be machined, larger sizes can be chucked. Either air or mechanically operated chucks can be used. All machines have individual drive from a single motor.

Binks Circulating Pump Serves as Agitator

Binks Mfg. Co., 3114-38 Carroll Ave., Chicago, Ill., is offering the No. 460 series combination agitator and circulating pump units for use in spray finishing work. Perfected for large automotive plants, these units are now available to all industries where

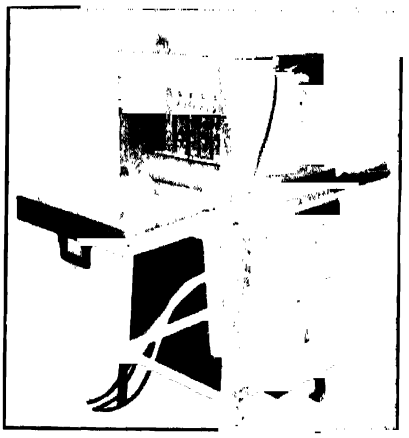


a small paint circulating system is desired. The unit is adaptable to all Binks Type TU tanks, and is said to be suitable for multiple spray gun operation, and for short pipe runs. It can be mounted on the tank as shown or can be mounted above the tank and driven by a flexible shaft. Either air or electric motors can be used to furnish the driving power.

Aluminum Rivet Heater Developed by A.C.F.

The "a.c.f." Berwick electric aluminum rivet heater offered by American Car & Foundry Co., 30 Church St., New York, N. Y., has 12 slots on each side of the heater so that 24 rivets can be heated at once. Rivet diameters run from ⅛ to 1⅛ in. Length of heat depends upon rivet length, which can be up to 4 in.

This heater is equipped with fully automatic temperature control, so that any temperature between zero and 1,000 F. can be obtained. Within 3 min., 24 rivets of practically any size can be heated to 400 F.; if it is desired to heat them to 950 F. it will take approximately 4 min. Heater can be used for annealing, or for heating rivets to drive hot. Likewise it is feasible to use the heater for heating aluminum rods for making a rivet-head, bolt-head or forging. Heater rating is approximately 15 kva. and

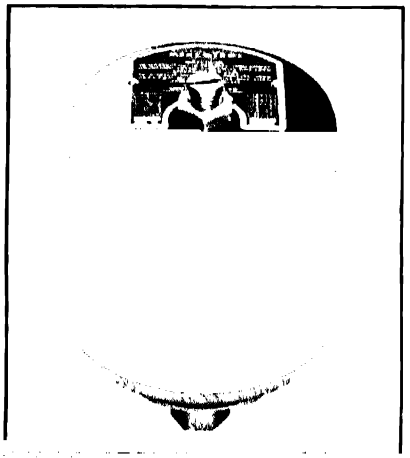


it can be built for any a.c. voltage. There are two ranges of speed one high, to get the heater hot, and the other low, to keep it heating.

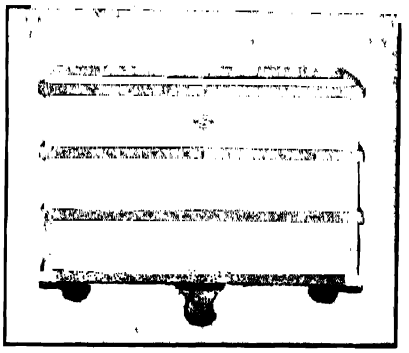
'Mercotrol" Pressure Switch Has 10-70 Pound Range

The Model No 15-45 "Mercotrol" mercury contact pressure switch, developed by Center & Giveen Co., 2024 University Ave., Berkeley, Calif., has a cut-in pressure range of 10-40 lb, and a cut-out pressure range of 20-70 lb. Pressure differential between cut-in and cut-out can be varied from 10 to 60 lb.

Said to be ideally suited for small



pressure systems, this switch is designed for service on non-corrosive liquids or gases. Mercury tubes are securely inclosed in a steel shell covered with Bakelite. A quick tripping action is imparted to the tube by a patented snap-action feature, eliminating chattering. Complete unit is claimed to be positively moisture, insect and dust proof.



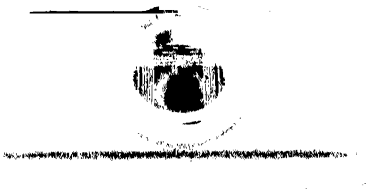
Spaulding Fibre Truck Features Ease of Handling

The Style A factory truck offered by Spaulding Fibre Co., 484 Broome St., New York, N. Y., is claimed to combine long wearing quality, light weight and convenience of handling Body is of vulcanized fibre, while the bottom is of wood, with hard-wood cleats to which casters are attached. Casters are 4 or 4½ in. in diameter, and can be furnished with iron, fibre or rubber-tired wheels. Bands are made of oak reinforced with steel angles and corners. Trucks can be made to any dimensions desired.

Fell Precision Level Needs Only One Setting

Only one setting of the level is required when leveling machine tools or other equipment with the all-way precision level offered by Wm. B. Fell Co., 700 South St., Rockford, Ill. This level, easily read to 0.00025 in., also shows 0.0005 in. per ft. With this extreme range the device can also be used for accurate checking of straightness on work that does not need to be level, and as a time saver for leveling where extreme accuracy is not needed

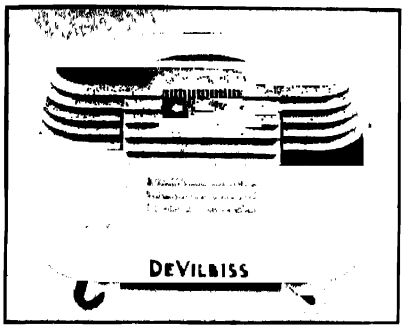
Heavy sections are employed in the level to avoid possible temperature distortion. Graduations are in 0.0005 in. per ft., and form squares about a circular bubble, thus giving coordinate readings. Graduations are on the side of the glass toward the



bubble. This allows the use of heavy ½-in. thick glass. Base is made of heat-treated cast iron, lapped flat by optical methods. Glass assembly is mounted solidly in a spherical surface which is an integral part of the base casting. Four thumb screws under the cap permit adjustment.

DeVilbiss Portable Unit Has High Efficiency

The Type NKB portable air compressor for operating small paint spraying equipment, developed by the DeVilbiss Co., Toledo, Ohio, is claimed to have an efficiency high enough to enable it to do the work of considerably larger units. Rated at ½-hp., it is the successor to the company's former Type NK outfit, and is the companion piece to the ¼-hp. com-



pressor introduced recently Weighing only 72 lb., the unit is readily portable. Actual delivery is 4 55 cu. ft. per min. at 45 lb. pressure. It is claimed to be suitable both for interior and exterior painting in factories and for production work

Chelsea Exhaust Fan Mounts in Roof or Wall

The Type IND industrial belt-drive exhaust fan made by Chelsea Fan & Blower Co., 370 W. 15th St., New York, N. Y., can be installed either in a wall or in a compact penthouse unit which fits a level opening in the roof Fan is belt-driven to reduce motor cost and save power consumption. A protruding orifice permits greater air delivery, while a heavy-duty die-stamped blade assures precision balance. Ball bearing motors and rugged all-steel construction make for durability. Capacities range from 7,000 to 30,000 cu ft. of free air per min., with motors ranging from 1/3 to 1½ hp. Shipping weight is 115 to 410 lb.



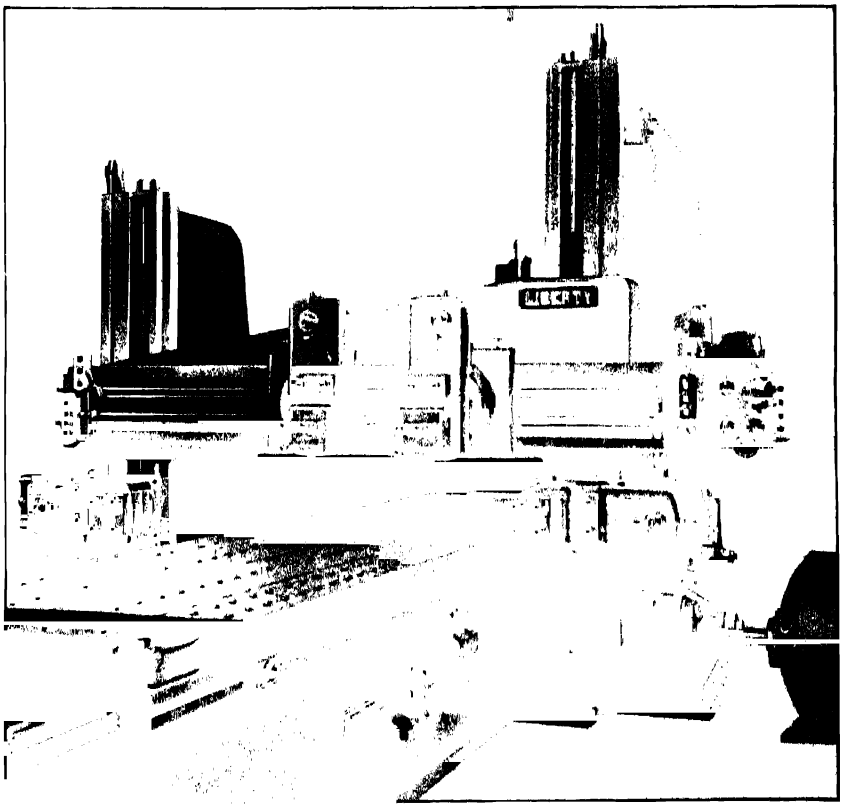
"Ideal" Insulation Former Makes Uniform Slot Linings

Neat, uniform slot linings can be easily made with the insulation former offered by Ideal Commutator Dresser Co, 1057 Park Ave., Sycamore, Ill Either plain or cuffed insulation of any length up to 8 in. wide may be handled. Machine operates by turning a hand crank while insulation is guided between a rubber roller and two creasing rollers



by aluminum brackets The rubber roller protects insulation and prevents the creasing roller from cutting through. Any desired width of trough up to 1½ in. may be obtained by adjusting the span between the two hardened steel creasing rollers.

Heavy-Duty Movable-Housing Planer Developed by Liberty Machine Tool



Liberty Machine Tool Co., 1050 Weller Ave., Hamilton, Ohio has developed a heavy-duty convertible planer with a movable, motorized left-hand housing. Maximum distance between the housings is 73 in., with a minimum distance of 42 in. Rail heads are offset towards the center and side heads are offset towards the top, with all heads and tool slides having power rapid traverse and power feed in all directions.

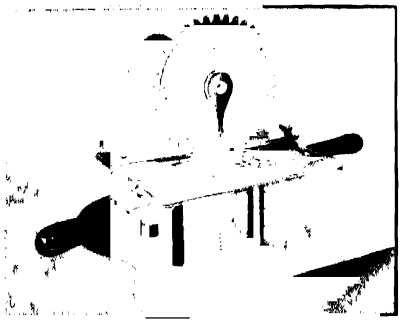
Housings are of heavy construction, with extremely wide faces. All screws are stationary with revolving nuts operating on thrust bearings. Table is of the flanged boxed type with full length clamps on both sides which are lubricated by felt wicks. Bed is of the inclosed type, with a flange on the bottom for fastening to the foundation. It is provided with a double wall through the gearing section. Forced feed lubrication is used.

The machine has electrically operated mechanical friction feed throughout to all heads, allowing the rail and each side head to be independent units with separate motors for each unit. Side heads have counter-weights which are suspended inside the housings. There is nothing below

the floor line of the machine, with only counterweight support brackets on top of the machine Table speeds are available to suit requirements

Bates Stamping Machine Marks Plates or Parts

The No 5 name-plate stamping machine offered by H O Bates, 245 N Broad St, Elizabeth, N J, stamps name-plates, parts or pieces ranging from 0 005 in to 3¼ in thick, and up to 9 x 7½ in in length and width Machine has a double row heavy-duty SKF bearing in the die wheel for easy turning and accuracy By a powerful screw, nearly three tons



pressure can be applied which permits stamping stainless steel and other high-strength alloys Depth of impressions can be easily controlled for stamping soft materials Standard machine is available with dies ranging from $\frac{3}{32}$ to $\frac{3}{8}$ in Extra die wheels can be furnished, and special characters can be substituted

Paragon Electric Timers Have Wide Interval Range

Paragon Electric Co, 37 W Van Buren St, Chicago, Ill has announced 128 models of interval timers and time delay relays designed for all types of electrical equipment which must be accurately timed in split seconds, minutes or hours

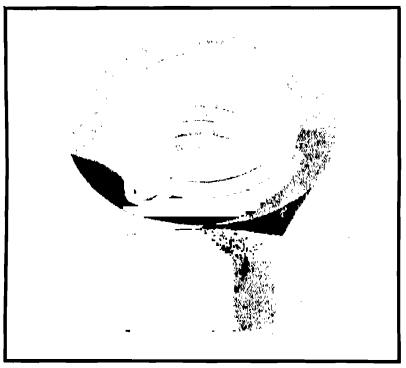


Powered by slow-speed, self-starting synchronous motors, these all electric controls are equipped with fast acting, silver contact micro switches Manual or automatic reset models for built-in flush panel mounting, inclosed surface mounting or wall mounting are available

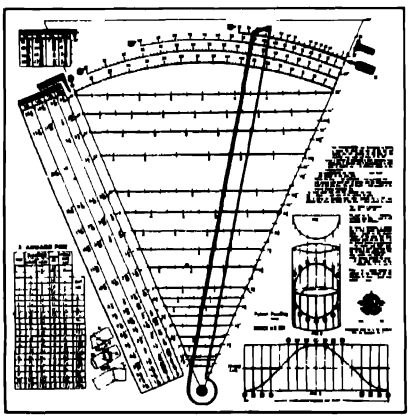
"Security" Lock Nut Uses Elliptical Spring Retainer

A lock nut which is claimed to permit tightening up or backing off years after application without loosening its grip has been developed by Security Metal Products, Inc, 362 E Kalamazoo Ave, Kalamazoo, Mich Known as the "Security" lock nut, this device utilizes a slightly elliptical spring-steel retainer permanently seated in the head of a standard nut

When the nut is applied, the retainer is distorted from an elliptical into a circular shape, thus setting up a powerful spring pressure between the bolt threads and the retainer threads Neither the bolt threads nor the retainer is injured

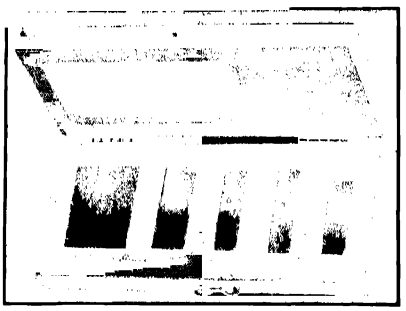


when applying or removing Nut is started on the bolt with the fingers and a wrench is used when the retainer threads start to engage the bolt threads



"Wolfe" Angle Meter Aids Cutting Pipe Joints

Distributed by Interstate Sales Co, 1123 Broadway, New York, N Y, the "Wolfe" angle meter is said to save considerable time in marking pipes for cutting at odd angles Adaptable to any angle from 0 to 90 deg in steps of 1 deg, on diameters from 1 to 20 in, this device enables the pipe to be marked directly without calculations of any kind Using a method of measuring in both directions from the center line, it requires only four measurements to mark a pipe or stretch out in sixteen different points on the circumference Angle meter measures only 12x4½ in when folded



"Mechanic's Own" Gage Blocks Offered by George Scherr

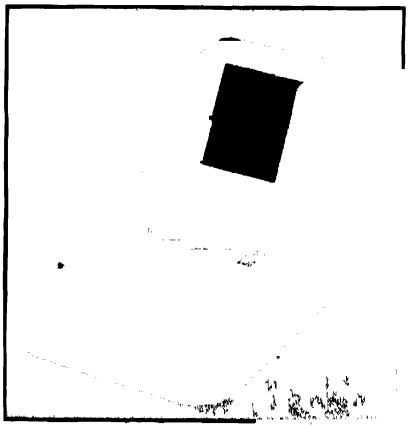
George Scherr Co, 128 Lafayette St New York, N Y, has added the 'Mechanic's Own" set to its line of 'Ultra-Chex" precision gage blocks Designed as a unit for the toolmaker's and mechanic's tool box this five-block set enables a machinist to produce a part to within extremely accurate limits

The set consists of gage blocks accurate to within 8 millionths of an inch in the following lengths 1 0000, 0 5000 0 2500 0 1250 and 0 0625 in

TelAutograph "Telescriber" Transmits Messages, Sketches

An improved "Telescriber" for instantaneously transmitting written messages and sketches over wires has been announced by TelAutograph Corp, 16 W 61st St, New York, N Y This instrument transmits writing sketches or designs in facsimile to a number of stations simultaneously or to any one or more stations selectively, within one building or between buildings miles apart

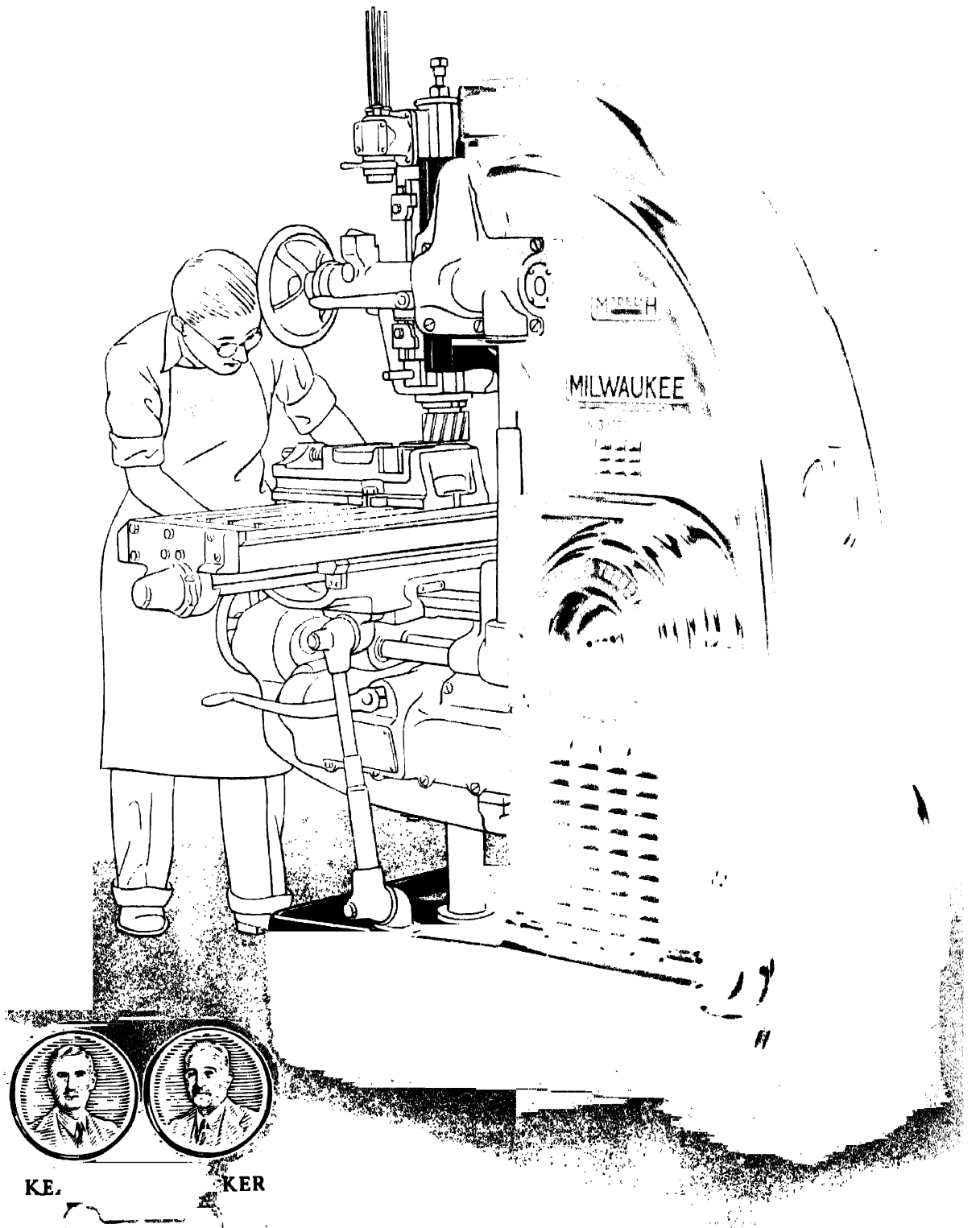
Machine measures only 12½ in



In vertical Milling Machines also, rigidity originates in the column — the backbone of the machine—and determines the productive capacity of the machine more than any one other factor.

Note how carefully the column of a Milwaukee Vertical Milling Machine has been engineered for the proper distribution of metal — an inside horizontal wall divides it into a double box section, the cross mounting of the motor permits a solid rear wall, which, together with the solid front face, assures an unusually rigid structure.

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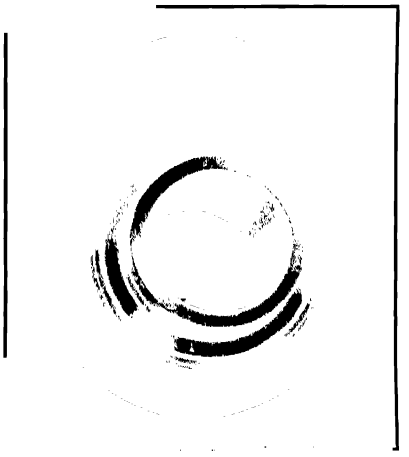
KE. KER

MILWAUKEE MILLING MACHINES

wide, 18¾ in deep and 10⅝ in high It operates on alternating current Units are available which both send and receive, while others receive only

"Sealmaster" Hanger Bearings Designed for Screw Conveyors

Stephens-Adamson Mfg Co, Aurora, Ill, has developed a line of "Sealmaster" ball bearing hanger bearings especially for screw conveyor service Permanently sealed and lubricated for life, these self-aligning bearings require minimum power, while their

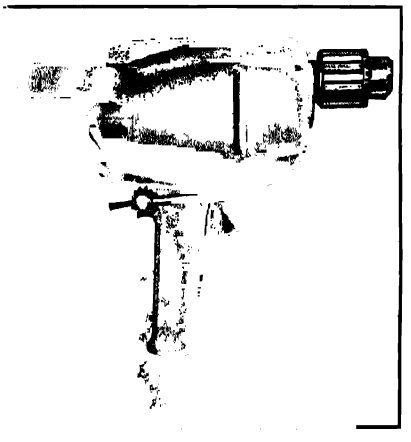


compact Meehanite housings offer minimum obstruction to flow of material

All parts are specially treated to resist rust Bearings are available in shaft sizes from 1 7/16 to 2 7/16 in

Skilsaw Half-Inch Drill Has Anti-Friction Bearings

A ½-in drill equipped with anti-friction bearings throughout has been developed by Skilsaw, Inc, 5033 Elston Ave, Chicago, Ill This Model No 80 drill weighs only 8 lb, is 11½ in long, and measures 9¼ in high Compact construction permits use in



close quarters, while die-cast body combines greater strength with lighter weight Helical gears promote smooth performance The drill develops a no-load speed of 450 rpm and a full-load speed of 300 rpm

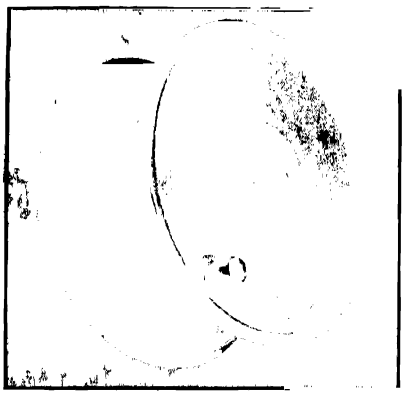


Lewis-Shepard Hydraulic Truck Helps in Moving Machine Tools

The Lewis-Shepard Sales Corp, 245 Walnut St, Watertown, Mass, has developed an open-end hydraulic lift truck especially adapted for moving massive top-heavy machine tools This truck is claimed to provide speed and safety in raising and lowering the loads, as it has extra-wide spreading arms, special levers for picking up heavy objects, and other features for added safety and convenience

Schramm Live Hose Reel Handles Air or Water

A new type of live hose reel developed for use with either water or compressed air has been made available by Schramm, Inc West Chester, Pa These reels which are available in

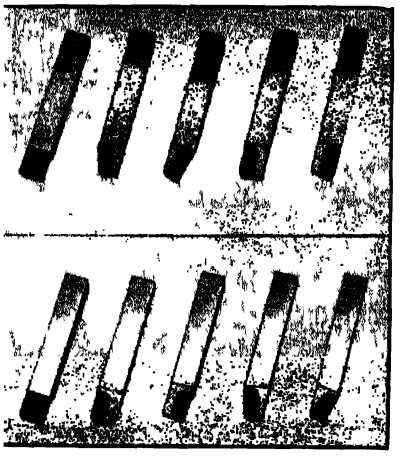


either wall or tank mounting types are designed so that 3 ft or the entire 50 ft of hose can be unreeled and the valve then opened

Valve is built inside the reel and is made of standard valve parts It is self sealing, with no adjustments packings or stuffing boxes Reel side numbers are spun and welded to hub for extra strength Heavy bronze bushings support the reel

Standard Carbide Tools Offered by Carboloy

Manufactured on a mass-production basis, a line of standard cemented-carbide tipped cutting tools has been introduced by Carboloy Co, 11149 E



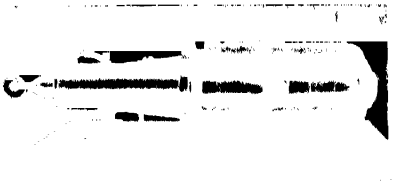
Eight Mile Rd, Detroit, Mich In addition to covering in five standard styles and three grades, the majority of all turning, boring and facing applications, these standard tools are also capable of simple conversion, by the purchaser, into hundreds of 'special' tools, thus obtaining such tool forms at a total cost only a little more than new standard tools

Shown are two complete sets of tools—one for cast iron and one for steel—in one of the seven sizes in which these are available Ready differentiation between tools designed for steel cutting and those intended for machining cast iron is provided by coloring the shanks

Introduction of a standard line of Carboloy tools for machining steel has been facilitated by development of a general purpose grade for steel cutting Tools made of this grade (78B) will stand more abuse than those of the 78 grade, while they also have greater resistance to abrasion than the 78A grade They are designed to take cuts up to ½ in deep at feeds up to 0 030 in For machining cast iron the standard tools are available in two optional grades

"Welco" Push-Pull Motor Exerts 4,000-Lb. Thrust

B A Wesche Electric Co, 1622–1628 Vine St, Cincinnati, Ohio, has developed a type of thrust mechanism which translates revolutions into



practical, powerful straight line motion, delivering a thrust up to 4,000 lb Being entirely mechanical, with the thrust bar connected direct through differential gearing to a powerful torque motor, this "Welco" push-pull motor is not restricted to vertical or semi-vertical mounting



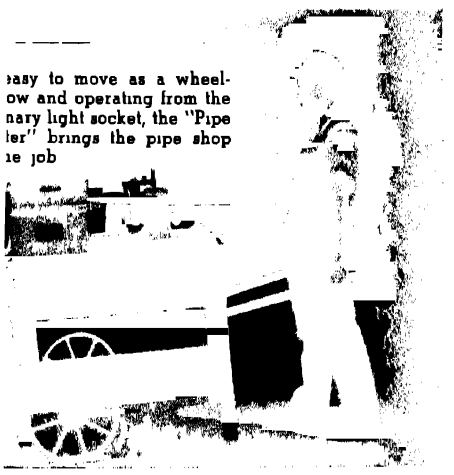
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Use margin of page if necessary.

It can be used horizontally, upside-down or in any conceivable position. Also, since the motor is reversible, a pulling motion of equal force to that of the thrust is available.

Improved Center Point Lube Needs Only One Application

Based upon initial developments in 1937, Chicago Mfg. & Distributing Co., 1936 W. 46th St., Chicago, Ill., has developed an improved lathe center point lube having the consistency of the No. 2 grease. With this lubricant it is claimed that only one application is required for any one job being turned in the lathe. Thus there is no lost time for stopping to relubricate the work, precision work is promoted because the lathe center can be drawn up more snugly, and less power is required to operate the lathe. It is further claimed that it is not necessary to use high speed steel lathe centers when using this lubricant.

G. E. Inkless Recorders Include D. C. Instruments

The Type CF line of inkless recorders developed by General Electric Co, Schenectady, N. Y, (*AM*—Vol. 83, page 272), has been extended to include direct-current instruments. Voltmeters, ammeters, millivoltmeters, milliammeters, and microammeters are available. Identified as the CF2 line, the d.c. instruments make it economical to apply recording instruments to many applications where previously the expense of suitable equipment could not be justified. Because of their inkless operation, they are suitable for general testing purposes and for use on moving vehicles. The recorder is portable and is suitable for either indoor or outdoor applications. It makes possible continuous operation for 30 days without attention, and may be operated at temperatures from —10 to 120 F.

'Markal" Solidified Paint Marks Hot or Cold Surfaces

A solidified paint in stick form, which can be used for marking either hot or cold surfaces, has been developed by Markal Co., 6 E. Lake St., Chicago, Ill. Known as "Markal A", this material is especially adapted for marking cold metal parts which require subsequent heat-treatment up to 1600 F. The part can be immersed in either oil or water immediately after heating without impairing the legibility of the marks. Available in white only, it is claimed not to flow, run, char, nor discolor. It is also claimed the markings adhere tenaciously to the metal, and will withstand all weather conditions without chipping, peeling or cracking after the surface has cooled.

Square D "Multi-breakeR" Protects 3 Phase Circuits

Square D Co., Detroit, Mich., has announced the Type M "Multi-breakeR" for use on 3-phase, 4-wire, solid-neutral a.c. circuits of 120-208 volts. When an overload occurs on any one pole, all poles trip simultaneously. Breakers are trip-free and cannot be held closed on a short or overload. Indicating units are calibrated and sealed at the factory so that intended capacities cannot be exceeded. Capacities range from 15 to 100 amp.

U. S. Rubber Develops Synthetic Rubber Clothing

Synthetic rubber clothing providing superior protection for industrial workers has been developed by United States Rubber Co., 1230 Sixth Ave., New York, N. Y. This clothing, made of "Synthal," resists oils, greases, acids, alkalies, and similar chemicals. It is also strongly resistant to most enemies of natural rubber, such as heat, sunlight and aging. All seams of the garments are vulcanized, doing away with stitch holes which formerly were a means of penetration.

NEW MATERIALS

"Deltabeston" Aircraft Wire Announced by General Electric

"Deltabeston" light weight small diameter aircraft wire which can be used to carry power to any part of a plane with safety has been announced by the Appliance and Merchandise Department of the General Electric Co., Bridgeport, Conn. This wire can be used for storage battery leads, circuit wiring for lamps, instrument wiring and other similar applications. It is flame-proof, highly resistant to heat, oil and moisture, and is available in sizes from No. 22 to 2/0, inclusive.

Metal Finish Produces Grain at High Speed

A finishing schedule that greatly reduces the time required for grain work is announced by Maas & Waldstein, 438 Riverdale Ave., Newark, N. J. In this schedule a special speed primer is used as the base coat. This coat will dry out of dust in five minutes and is ready to receive the graining ink within an hour. After the ink is dry, good results can be obtained by using a clear air-drying lacquer as the top coat and eliminating baking. For a more durable finish, clear "Codur" baking lacquer is recommended for the top coat. This finish can be baked thoroughly in 30 minutes at 275 F.

AMERICAN MACHINIST

November 13, 1940



Sheets for the Wind—*Lockheed uses specially built routers to profile aluminum sheets in virtually any quantity*

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TO HELP YOU

help America

AMERICA is rushing to arm. *American Machinist,* as it did during the World War, is rushing into print the latest authoritative data on materials and on armament production—written to help you help America. Here are typical recent comments on these special sections.

"Please forward at your earliest convenience 1400 reprint copies each of the following articles: The Working of Magnesium Alloys, The Working of Aluminum Alloys. These will be used in our engineering training program" . . . J. E. Lewis, Engineering Manager, Lockheed Aircraft Corporation.

"In your August 21 issue was a fine story on The Working of Aluminum Alloys. Would it be possible to receive 10 copies of this section for use in our organization?" . . . S. T. Day, Jr., Engineering Dept., Vought-Sikorsky Aircraft.

"Will you please send to J. J. Malespina, Chief Draftsman, 3 copies of The Working of Aluminum Alloys. Your early consideration will be greatly appreciated." . . . P. M. Farmer, Chief Engineer, American District Telegraph Company.

"If you have 5 additional copies of the article on manufacture of the 75-mm shell case, we should be pleased to have you send same to us." . . . Geo. E. Bass, President, Ferracute Machine Company.

"Please send about 10 copies of your folder on how to machine 75-mm shells. We have had a few copies of this but have run out and are in urgent need of more" . . . H. L. Joseph Humphrey, Ex-Cell-O Corp.

"We understand reprints are available of an article on the manufacture of 75-mm shells. We shall appreciate your sending us 4 copies." . . . G. H. Pfefferle, Chief Engineer, Dresser Manufacturing Co.

• • •

10 special sections on the Working of Materials, and 5 on Armament production have already appeared. Another Armament section is in this issue. More are to come in every succeeding issue of *American Machinist*—always first with the latest metal-working data. Watch for them—use them.

WHAT'S IN THIS ISSUE

BRAZEN

Like welding, brazing is one of those originally crude processes that has emerged into respectability. Though long used in production, its future applications, we feel, are bound to show a tremendous increase. The main reason is the controlled-atmosphere furnace, in which parts can be copper brazed without subsequent cleaning. And what a joint! Other factors making for improved quality with lowered cost are wide furnace flexibility and elimination of extensive design changes. On page 903 A. K. Phillippi, Westinghouse manufacturing engineer, outlines a few of the economies.

TWO IN ONE

An effective way of boosting output while cutting costs is to do two operations at once. The trick is to combine them without overwhelming complications. On page 907 Herbert Chase, roving reporter, presents an example of this type whose solution proved to be extremely simple. Where production warrants, the same approach could be used anywhere.



PHILIP M. McKENNA
. . . *double carbides for steel*

TIPPED FOR TORTURE

The punishment carbide-tipped tools can take is often amazing. So is the work they can do. But like other spectacular improvements over previous practices, they yield disappointment when improperly used. The best material for cutting steel, for instance, might turn out to be an entirely different compound from that giving best results on cast iron. An analysis of the various conditions and ways of meeting them is presented on page 917 by Philip M. McKenna, president of McKenna Metals Company. In it he discusses properties of the recently introduced titanium-tungsten carbide you've heard so much about.

RETURN ENGAGEMENT

You've made H. E. Linsley's acquaintance in these pages before—in the August 7 number, to be exact, when he described Wright Aeronautical's answer to the problem of machine tool lubrication. Mr. Linsley is with us again, on page 908, where he discusses precision thread grinding as used by Wright in engine manufacture. Techniques and practices satisfactory to engine makers should be of considerable interest to all engaged in producing for defense.

TOOLED FOR CHANGES

You know that feeling just as the new line's running smoothly, Engineering announces several dozen changes in the model. At least one plant will have fewer headaches than usual when that happens. The plant is the diesel engine shop recently opened by International Harvester in Milwaukee. In it everything—well, nearly everything—has been planned for extreme flexibility. In less than eight hours, standard time, the whole works can be changed over from one model to another. The secrets are bared beginning on page 910.

GREAT PROFILE

From California, as you might expect, emerges another seemingly cockeyed idea for working sheet aluminum. After we learned of the Guerin "rubber stamp" blanking process we were ready to believe anything. It's a good thing. For along comes Lockheed with specially built routers for profiling, if you please. Small production, large production, big shapes, little shapes—it's all the same. Details by Louis H. Biehler, on page 926, open up this issue's Armament Section. After breaking into the aircraft industry as a Kinner draftsman, Mr. Biehler joined Lockheed in '34 as a tool designer. Last year he was manager of manufacturing engineering. He's now superintendent of tooling.



LOUIS H. BIEHLER
. . . *for profiling: a router*

X-RAY FOR ARSENAL

There's nothing amazingly new about using the X-ray for weld inspection. But with Army specifications and testing becoming ever more strict, we thought you'd be interested in seeing what one of the Arsenals is doing with X-rays. Problems include materials handling, radiant-energy protection, and high-speed photo-finishing. How they're dovetailed into a modern X-ray inspection department deep in the heart of a metal-working plant is explained on page 930.

WHILE IN CANADA

Production for defense—and offense—is being pushed to the limit. One important weapon is the Bren machine gun. Tooling used in making these guns is of considerable interest, though much of it is held strictly secret. Passed by the censor, though, is a description of "checks" which have been designed for certain types of thread gages. You'll find it on page 932.

COMING

Fluorescent lighting has received a lot of attention lately, shining as it did so suddenly on the world. Exactly what is fact, what is fiction, concerning industrial applications will be outlined soon. Also scheduled are discussions of balancing rotating machinery and of centerless grinding for small lots. They'll appear soon in AMERICAN MACHINIST.

MAKING BETTER MACHINE TOOLS
with better machine tools



Cincinnati Hypro Planer handling highly productive work for a well known machine tool builder.



Cincinnati Hypro Planer Miller performing another operation on machine tool bed.

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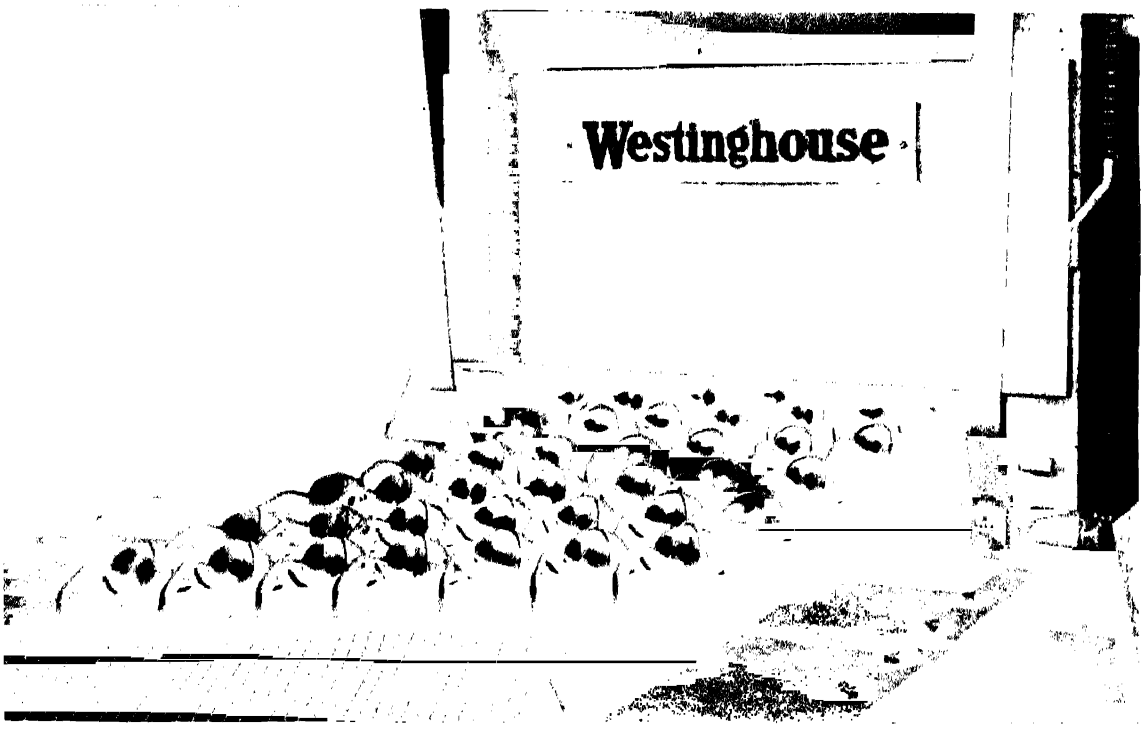
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Copper brazed in a controlled-atmosphere furnace, refrigerator mufflers emerge bright and clean

Saving with brazing

BY A. K. PHILLIPPI, MANUFACTURING ENGINEER, WESTINGHOUSE ELECTRIC & MFG. COMPANY

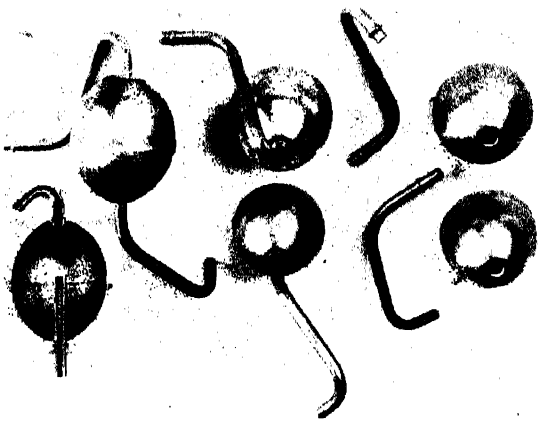
Copper brazing in controlled-atmosphere furnaces proves an effective method of saving on assembling and cleaning costs

COPPER BRAZING of unit assemblies for air conditioning and refrigerator mechanisms in a controlled-atmosphere electric furnace has improved quality, reduced rejects and saved as much as 25 per cent. Though the controlled-atmosphere furnace is not a cure-all for brazing troubles, when properly used it can speed production, simplify inspection and produce a better, neater looking part than obtainable by torch brazing.

Small metal mufflers for refrigerating units are typical of multipiece assemblies produced by copper brazing. They emerge from a controlled-atmosphere furnace perfectly free from dirt, grease and oxides. Cleanliness is essential for parts that come in contact with refrigerants. The muffler consists of seven parts: an inlet and a discharge tube, top and bottom shell halves, and three brazing rings.

Tubes, of double wrapped steel tubing, are also made by controlled-atmosphere furnace brazing. Rolls of copper-plated strip steel are passed through a set of rollers, forming a tube which is sized in a drawing die and which has its double wall brazed. Close tolerances are held by controlling accurately both steel and plate thickness. Care is taken in designing and fabricating bending fixtures so that the ends are kept perfectly round and are held to proper dimensions. In assembly for brazing into the muffler, a small copper ring is pressed on the tube and the tube pressed to a given depth into the small swaged hole in the top half of the muffler.

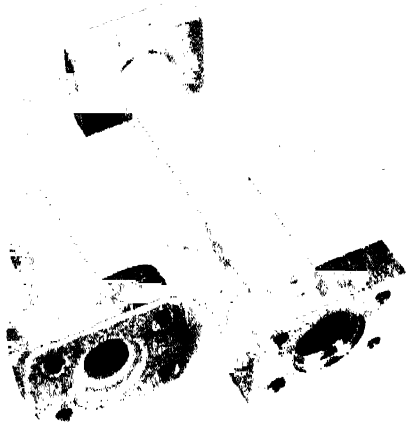
The discharge tube has an expanded section approximately $\frac{1}{8}$ in. from the end which is pressed into the swaged hole in the bottom half of the shell, the expanded section holding the copper ring in position adjacent to joint to be brazed. Top and bottom shell halves are made in a punch press. The swaged holes have a wall about $\frac{1}{16}$ in. long. The flared section of the bottom shell is a good snug fit on the top half. After the complete assembly has been made, a large copper ring is placed next to



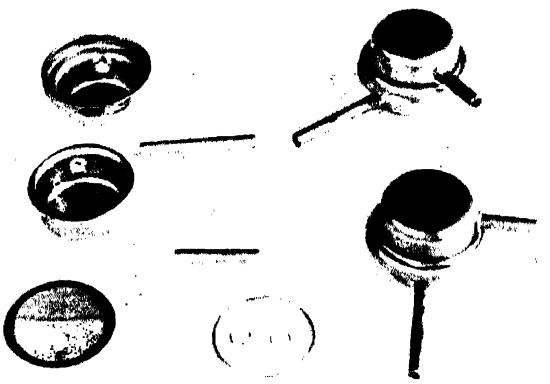
Muffler assembly consists of four major parts and three copper brazing rings. Furnace brazing cut cost 7 per cent and dropped rejects to 0.001 per cent



The float ball on the left was brazed using bronze and an oxy-acetylene torch; that on right was copper brazed in an electric furnace



Steel tube brazed to cold-rolled flanges when sawed in two replaces the unreliable casting at the left



This strainer, especially designed for furnace brazing, replaced one costing twice as much

the joint to furnish the brazing medium. As the entire assembly has a slight slope toward the tube end when on the furnace belt, the rings at the inlet tube joint and the middle muffler joint remain in place. All rings fit snugly. They are formed by winding the proper size wire on a mandrel and then cutting the coil into individual rings. It is important to place the open ends of the rings down, so that when heated they will not open up and fall off. All joints in this assembly are designed to hold themselves together, so that no supporting fixture is needed.

On this part furnace brazing saves 7 per cent over previous methods, and produces a product which is oxide, grease and scale free without any cleaning. Rejects are less than 0.001 per cent. The mufflers were formerly brazed using an acetylene torch with carbon dioxide gas to prevent oxides from forming on the inside.

Float balls to regulate refrigerant circulation must be free from oxide, flux and grease. The one on the left in the photograph was brazed using bronze and an acetylene and oxygen torch. It is covered with flux, oxides and brazing material, which must be cleaned off down to base metal at appreciable cost. The bracket at the bottom is spot welded only. In brazing the ball on the right in a controlled-atmosphere furnace, the two halves are placed together, a small piece of No. 22 copper wire is wrapped around the ball just above the joint, and the ends are twisted together. The twist keeps the wire in place until it melts. A small piece of No. 26 copper wire is wrapped around the joint between the bottom shell and the bracket to braze it solidly to the shell. This is in addition to a single spot weld. Cost is reduced about 6 per cent on each assembly, primarily because the balls come out clean and bright, eliminating former cleaning operations.

Because of limited production, a discharge flange and tube assembly involving a steel casting was rather expensive to tool up and machine. The mortality on these was quite high since some castings were porous. A modified assembly for furnace brazing makes two complete flanges when the tube is sawed in two. Flanged sections are made from cold-rolled steel bar stock cut to length. A simple drilling and counterboring fixture is all that is necessary. The tubing is a seam-welded steel tube whose outside diameter is qualified on a centerless grinder. In assembling for brazing, the tube is pressed into the flanges, the end of the tube forming one of the steps in the center hole. A copper ring is placed around the tube next to the flange and the assembly passed through the furnace. Saving on this part is about 25 per cent.

Many units designed for other fabrication methods can be more economically made by furnace brazing These small refrigerator mechanism parts are typical



Even flow of brazing material in this shell assembly simplified balancing The plug is turned on a screw machine while the shell is formed in a punch press





Heat treating effect of the brazing furnace eliminates a separate annealing operation prior to sizing these circulator shell assemblies

A small refrigerant strainer must be absolutely clean and free from oxides Assembly is simple, as the strainer is placed in the bottom half and the top half placed on top The two holes are held in proper alignment with short pins in a crimping press The straight section of the bottom half is crimped over, holding the complete assembly together The two tubes are pressed into position and two small rings placed over the tubes against the shell The large ring is then positioned around the crimp and the assembly is ready for the furnace These assemblies are placed in a rack which tilts the tubes slightly upward to prevent the rings from sliding off This strainer was never made by any other process, but it replaced a strainer that cost almost twice as much

In a circulator motor shell a heavy section was necessary on the closed end to give rigid support to the rotor shaft This shell is blanked and drawn and the hole pieced in the end The heavy shaft support is turned in a screw machine to fairly close tolerances It is placed in the hole, resting on the shoulder A small copper slug is then placed near the joint in such a position that asbestos curtains will not move it when entering the furnace After the support has been brazed in, the assembly is returned to the press room and is trimmed and sized Sizing is made possible by annealing while brazing, eliminating the necessity for an individual annealing operation The even spread of the brazing material, when furnace brazed helps materially in balancing this shell, in contrast with those which were torch brazed The assembly is made by unskilled help, which further reduces cost

Illustrated is a small collection of miscellaneous parts which are furnace brazed Each not only shows a saving in cost but presents a better appearance The bottom center piece is a small muffler having baffles spaced inside a steel tube These baffles are cups with holes pierced in the bottoms The cups have their sides slightly flared and when pressed into the tubing hug the walls tightly During this assembly a copper ring is placed against each cup to furnish the brazing medium

The objects at the extreme right and left of the picture are outlet box covers The cover itself is standard but has many different fittings brazed into it to meet certain requirements The part at the upper right shows the possibility of making a product combining a number of individual parts This unit contains a mounting

bracket, screen, purge valve and capillary tube inlet. All the parts in this picture have shown worthwhile cost reductions.

Products brazed in controlled-atmosphere furnaces will continue to increase. This type of furnace is ideal for brazing parts that must be perfectly free from dirt, grease and oxides. Such products, within limits of weight and size, can be furnace brazed with decided reductions in cost over ordinary methods still in common use.

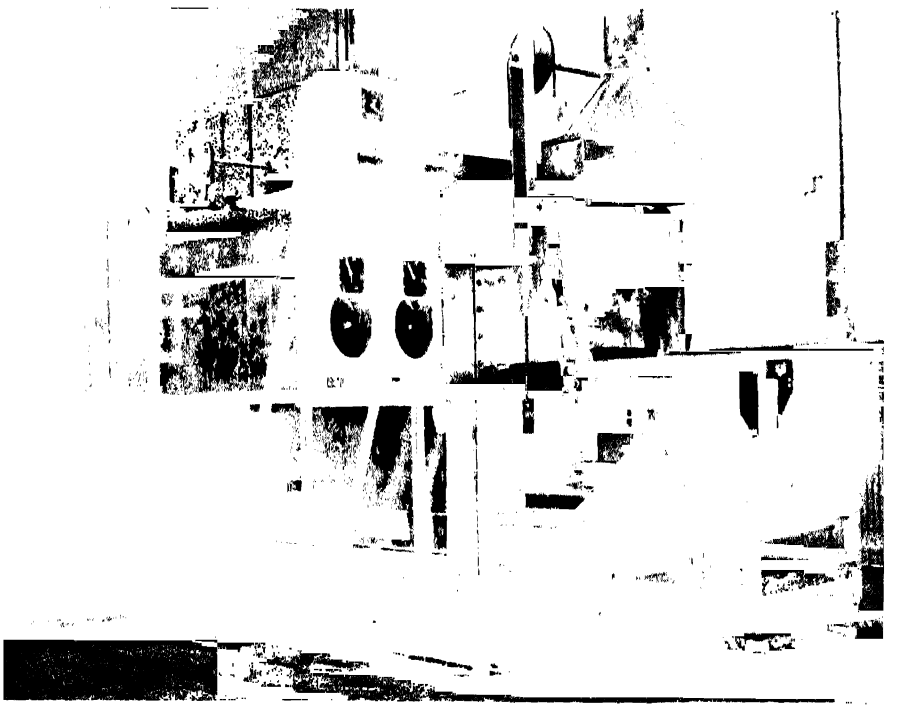
To secure maximum savings the furnace must be properly designed and matched to accommodate the quantity of parts. The furnace used at the Westinghouse East Springfield plant is illustrated. The class of work to be brazed determines the lengths of the heating chamber and cooling chamber, and fixes power required. The cooling chamber must be long enough to bring the temperature of the parts below the point where they will oxidize when exposed to room air. Belt speed is regulated by a variable-speed drive which gives a range of 25 to 125 ft. per hr. Inside the charge and discharge ends asbestos tape curtains help retain the reducing atmosphere when doors are opened to permit work to pass through.

The reducing atmosphere in this case is precombusted coal and water gas. The combustor consists primarily of a set of regulating throttles to control the ratio of gas and air mixture, which can be read on the flow meters in front of the combustion tank. This mixture is forced into the combustion chamber through a nozzle where it is burned. It passes through a cooling chamber to take out any water and then flows into the furnace proper.

Economical operation is based on such things as size, weight, and the number of pieces brazed per hour. This determines the amount of heat the furnace must furnish, the size of the belt, and the belt speed. Most furnaces accommodate a wide range of weights and sizes, having a variable-speed drive so that belt speed may be regulated to suit various conditions

The mesh type of conveyor for carrying the work through the furnace is used where the pieces are light and can be arranged on it economically. Where heavier pieces are to be brazed it may be necessary to use the roller-hearth type of furnace. This furnace has rollers spaced ten to twelve inches apart. These rollers are made of special steel designed to carry heavy loads at elevated temperatures, and are driven by sprockets and chains located outside the furnace shell. Bearings are of either the ball or roller type, located on the outer shell. These bearings are water cooled to dissipate the heat conducted by the shaft from the roller. In this type of furnace parts are usually loaded on trays, although when the design of the piece is adequate they may be carried through the furnace directly on the rollers.

Because of demonstrated savings, copper brazing in controlled-atmosphere furnaces is here to stay. Although the process has been only recently adopted, drastic cost reductions are so apparent that even small plants without volume enough to warrant purchasing a furnace are sending their work to job shops that can do furnace brazing.



Typical controlled-atmosphere electric furnaces for copper brazing are completely automatic in operation, and can be adjusted to handle a wide variety of parts. Atmosphere is precombusted coal and water gas

What's in a Shell Bore?

BY J. HOMEWOOD

DURING THE LAST World War I had three years of honest-to-goodness headache in machining the insides of both the 18 Pr. and 4.5 H E shells for the British government.

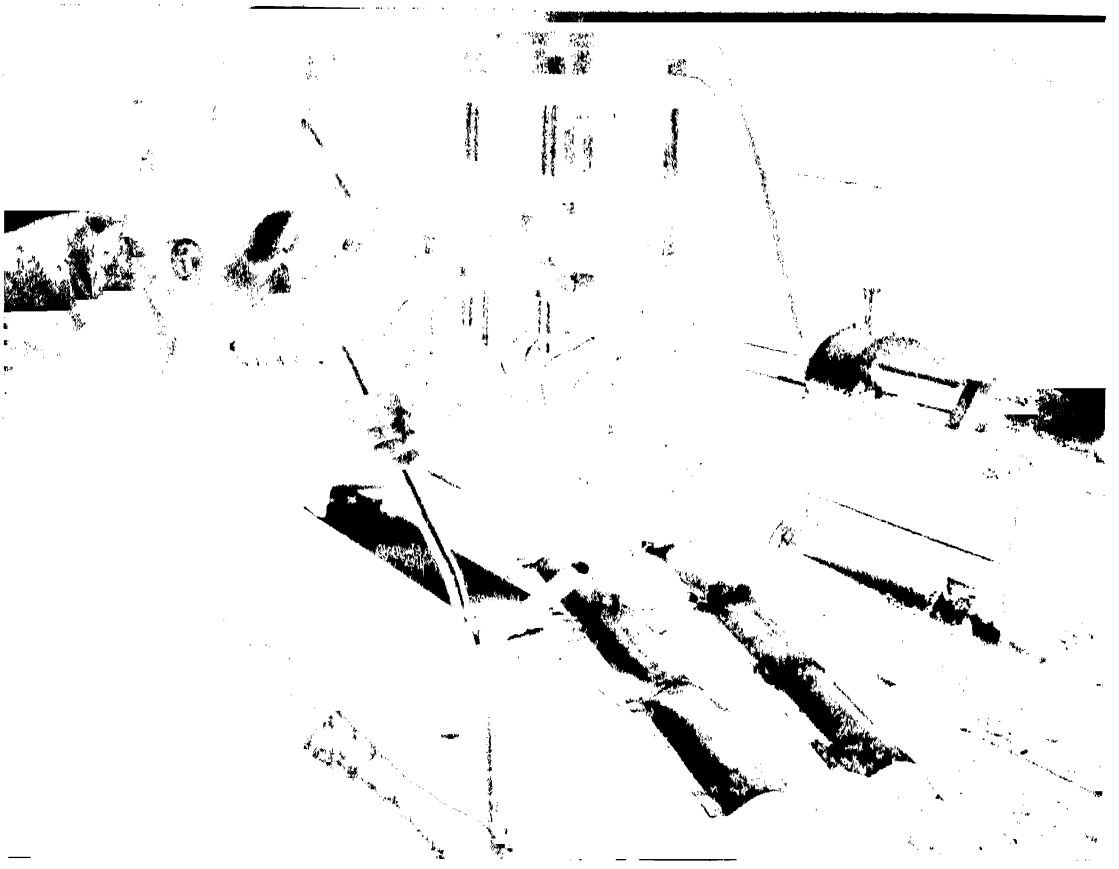
The insides of the shells must be well finished in order to prevent any corrosive action that might cause a premature explosion, but on to the outside of the shell, as Lucien I. Yoemans states (*AM*—Vol 84, page 526), there are certainly advantages in a coarse feed finish Personally I have a great antipathy for fine feeds and high polishes unless it be absolutely necessary

During the early stages of our 18 Pr. experience a cry that went up from the men on the inside-bore machines on account of the seeming unreasonableness on the part of the government authority. This ribbon-bedecked inspector insisted that no tit be left in the bottom of the bore. If he had explained to us the dangers likely to be caused everything would have run smoothly, but the attitude of the men was. "What's a tit more or less."

One of my men, a regular sea-trained Gawd-blimey from the East End, gave vent to his impatience in the following terms: "Tit in the dam bottom of the 'ole, strike me pink, what the bloody 'ell difference does it make any'ow; ain't they goin' to be blown in a thousand bloody pieces?"

ing Dry Ice Colder

SOME OF THOSE who reverse the old shrink fit practice by freezing the piece that goes inside the other, have found a new kink to get even lower temperatures. By mixing acetone with dry ice the temperature can be lowered about 50 F.



Flash is trimmed from an unwieldy die casting with this set-up eliminating the need for a large press. Hinge pin holes in lugs are also drilled. Production is about 50 pieces an hour

Trimmed and drilled at once

BY HERBERT CHASE

By ingeniously combining some standard units and a few small parts, a troublesome operation can be done with a simpler one

TOOLING for machining die castings need not always involve heavy equipment and elaborate fixtures. A case in point is the set up devised by Stewart Die Casting Division of Stewart-Warner Corporation for trimming flash and drilling fourteen holes in a cumbersome die casting.

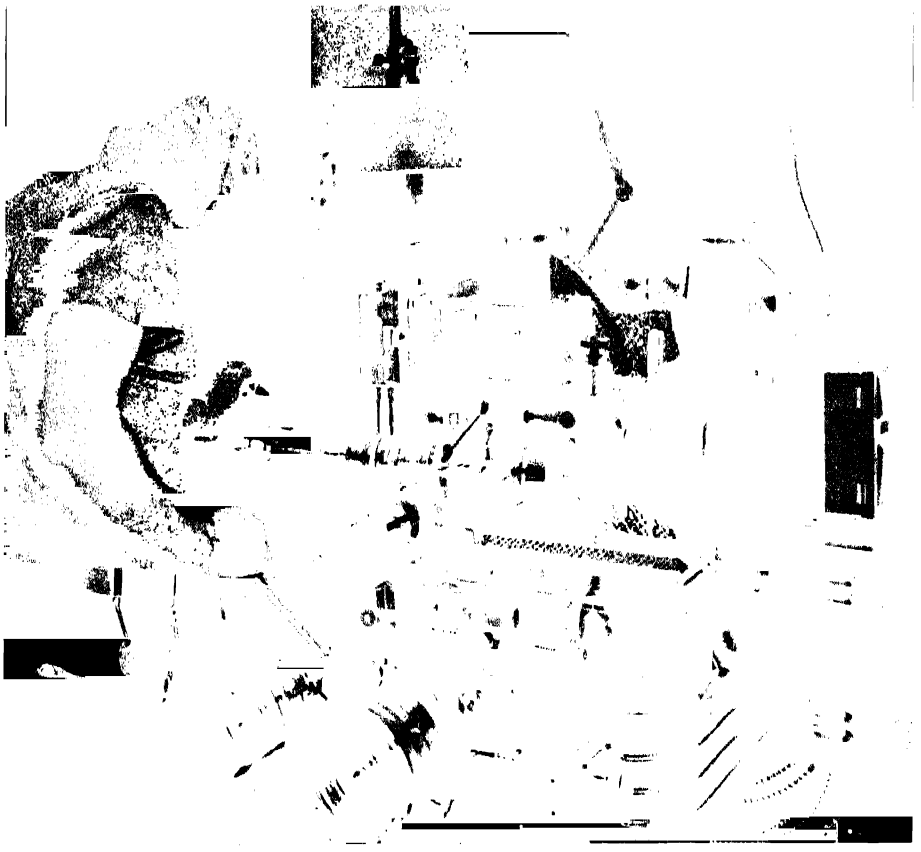
The casting in question is a section of a cable repair sleeve, measuring approximately 4 x 19 in. over all. It has four sets of ears at each side, forming parts of a hinge whose pins fasten the sections together in the complete unit.

In casting this part in zinc alloy, a fin left at the die parting runs around the contour of the piece. A rather large trim die is needed to remove this fin. Instead of doing this trimming in a punch press which would have tied up a rather large machine, it was decided to use a relatively light hydraulic press for the purpose. In fact the press was built into the die since this required little beside a standard hydraulic ram and cylinder and some tie bars.

It is necessary to drill hinge holes in this casting because, if they were to be cored a bulky and expensive core pulling mechanism would be needed on the casting die. Since the piece can be securely clamped in the trim die, it was decided to fit to the latter a pair of inexpensive drill heads, rather than to make a separate fixture and drill set up. The drill heads are mounted on tubes arranged to slide in castings bolted to the die supporting plates. They are traversed by racks meshing with pinions turned by a handwheel. Each drill unit has its own motor and is fitted with a geared head having two spindles on the required centers.

All four of these drills must be quite long, since they are traversed about 8 in. They are well supported in four bushings each, as they are only $\frac{1}{4}$ in. in diameter. All four drills are advanced simultaneously, each drill producing either three or four holes (since the lugs are spaced apart) and cutting through $1\frac{1}{2}$ to 2 in. of metal in all. Despite this, 50 pieces an hour are trimmed and drilled complete.

To insure proper lubrication, the set up includes a small pump to supply oil under pressure through a manifold and pipes to each bushing. This makes, in all, a self contained machine, but its slight extra cost is warranted because the castings are produced in large quantities, and use of the machine effects a considerable saving in time. It would, in fact, be a slow and rather difficult job to handle in any other way.



External threads are ground in studs, highly stressed cap screws, shafts and other important small parts. In the set-up shown two threaded connections are mounted back-to-back on an arbor, and threads are ground from the solid

Precision thread grinding

BY H. E. LINSLEY, WRIGHT AERONAUTICAL CORPORATION

Accurate ground-thread parts are needed in large quantities for aircraft engines. Wright tool engineers have developed a procedure that gives results

OF THE PARTS on which threads must be ground, studs involve the largest production quantities required for Wright aircraft engines. These are made from chrome-nickel SAE 3140 steel and are hardened to 32–36 Rockwell C. Because of the necessity for producing work of the highest possible accuracy, the blanks first are rough turned and hardened. The two ends, one of which is tapered, and the necked section between them then are ground to size in a centerless grinder. A driving dog is attached to one end, the part placed between centers, and the thread on one end rough ground, leaving approximately 0.008 in. on the pitch diameter for finish grinding.

The driving dog remains attached to the part until the finish grinding operation on the one has been completed. The roughing operation continues until the wheel requires dressing, some fifty pieces are thus roughed out, and then the wheel is dressed and these pieces are finished to size. The tail of the driving dog engages a slotted arm attached to the face plate of the machine and the lead of the thread thus is picked up automatically.

Since one of the threads is tapered, it is obvious that the pitch diameter must be measured at a predetermined distance from the end. This is done with a special indicator gage developed for this operation. V-type gaging rolls are used, a single roll being attached to the stem at the indicator while a double roll is mounted as a lower anvil. In place of the usual commercial practice of using one set of rolls to cover a range of pitches, one set is used for each different pitch. This eliminates errors caused by the difference in helix angle. A second dial indicator is used as an end stop, and both indicators are set at zero from a master stud. As each part is finished it is placed in the gage, turned until the end stop reads zero, and the pitch diameter variation is read on the upper indicator. Limits of as much as $\pm$ 0.00025 in. are allowed, but it is seldom that production parts exceed one-half of this limit. Lead errors are kept at a minimum by using lead screws for each pitch, the maximum error allowed being 0.0005 in. in one inch of length.

Wheel speeds are held constant at 2,500 r.p.m., with an 18-in. diameter

wheel, which is considerably higher than is common practice for this type of grinding. Speed of rotation of the work varies between 20 and 40 r.p.m., according to the diameter. Considerable experimental work was necessary before these speeds could be achieved. Wheels of different grades, grits and bonds were tried. The wheels now used are resinoid bonded, 150 grit, extremely hard, and have a fairly open structure.

Oil is used as a coolant. This oil plays a large part in both the finish obtained and in the output; a recent change of coolant stepped up the number of pieces per wheel dressing from 30 to 50 on the roughing operation. Under present conditions each machine will produce about 60 studs per hour, finish ground on one end.

Many Parts Ground

Thread grinding is not confined to stud production. Highly stressed cap screws, threaded shafts and many other important small parts are produced on these same machines. For parts of larger diameter and coarse pitch, such as cylinder barrels, the threads first are rough milled and then are ground on a fully automatic machine in which the wheel is dressed at the end of each grind and the necessary adjustment from rough to finish grinding takes place automatically. This frequent wheel dressing is hard on the diamonds and, for this reason, a somewhat softer wheel is used with a lower grinding speed.

For highly stressed nuts an internal thread grinder is used. This machine has a capacity of from 1 to 8 in. diameter. Most such parts are rough milled before grinding, as this has been found considerably cheaper than grinding from the solid, particularly in the case of larger parts where wheel wear would be excessive. This is not essential, and certain parts are ground direct from the solid without preliminary milling. For example, a 12-pitch thread $1\frac{1}{2}$ in. in diameter and $1\frac{1}{2}$ in. long can be finish ground from the solid in chrome-nickel-molybdenum SAE X4340 steel with a hardness of 290–321 Brinell in a total time of 10 min., using three machines for roughing, semi-finishing and finishing, or 32 min. on one machine, including dressing the wheel after the roughing and semi-finishing operations. The grinding wheel is about $1\frac{1}{4}$-in. diameter and rotates at 12,000 r.p.m. Threads produced in this way are superior in accuracy and finish to those produced by hobbing or tapping, and actually cost no more.

Checking the thread form and lead on internal threads proved a difficult problem until Wright tool engineers developed a simple checking device. This unit consists of a steel disk of the same outside diameter as the part, so that it may be held in the same fixture. Attached to the front face of this disk is a block to which a thin steel blade may be clamped securely. The front face of the blade lies exactly on the center line of the disk. The edge of the blade faces inward and corresponds with the inside diameter of the part.

Simple Thread Gage

When making a new set-up for grinding internal threads, or whenever it is desired to check the thread, this disk is placed in the fixture or chuck and a few threads ground in the edge of the blade. The blade then is removed from the machine and the thread form and lead checked in a comparator. Simple and inexpensive as this is, it has proven highly satisfactory and checks may be made at any time by simply inserting a new blade and placing the device in the holding fixture. The blades are made from 0.015-in. strip steel, although old safety razor blades would serve equally well.





The dial-indicator gage is used for checking the pitch diameter of taper-thread studs at a fixed distance from one end. Allowed limits are ±0.00025 in. on pitch diameter. Small parts on which threads have been finish ground are stacked in special trays having wood bases in which holes are drilled. Parts placed in these holes are kept separated, preventing damage to the threads. Ground internal threads are checked to close limits by using the special fixture shown above. Thread form and lead both are gaged by measuring gashes ground in the edge of a thin steel blade

Different diesels from one line

THE DIESEL ENGINE PARTS production line recently placed in operation by International Harvester Company at its Milwaukee Works is so flexible that parts for several different engines can be made in production quantities on the same lines with only minor changes in equipment. For example, the crankshaft line handles five sizes and one of the cylinder head lines handles two sizes. The new crankcase line produces three sizes for the TD-6 tractor engine which has a 3.875 in. bore and 5.25 in. stroke, the TD-9 tractor engine which has a 4.4 in. bore and a 5.5 in. stroke, and a gasoline adaptation of the latter. The changeover from one model to another can be made in about eight hours since it consists principally in changing the working heads on the drilling machine, changing some cutting tools and resetting the heads of the boring machines.

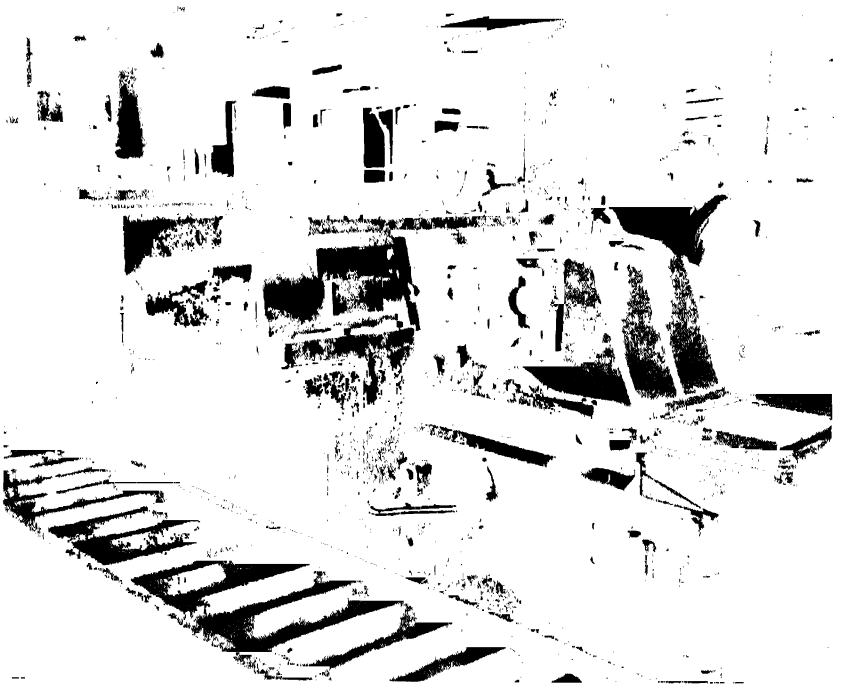
The new engine machine shop is located in a saw-tooth roof building equipped with fluorescent lighting which provides an average of 25 foot candles of light throughout the building. Layout has made possible large production in a limited space. No manual lifting or handling is required. Roller conveyors, automatic roll-overs and elevators all play their part. Materials enter the building at one end, finished parts are taken from the other end by skids and electric trucks. Space was saved by eliminating benches. Instead each machine has attached to it a tool box or table just large enough to hold necessary gages or tools for that machine and no more. No working platforms are needed as tables were placed at working height by setting large machines in pits. All piping and conduit is in the concrete flooring.

Some tool practices followed are:

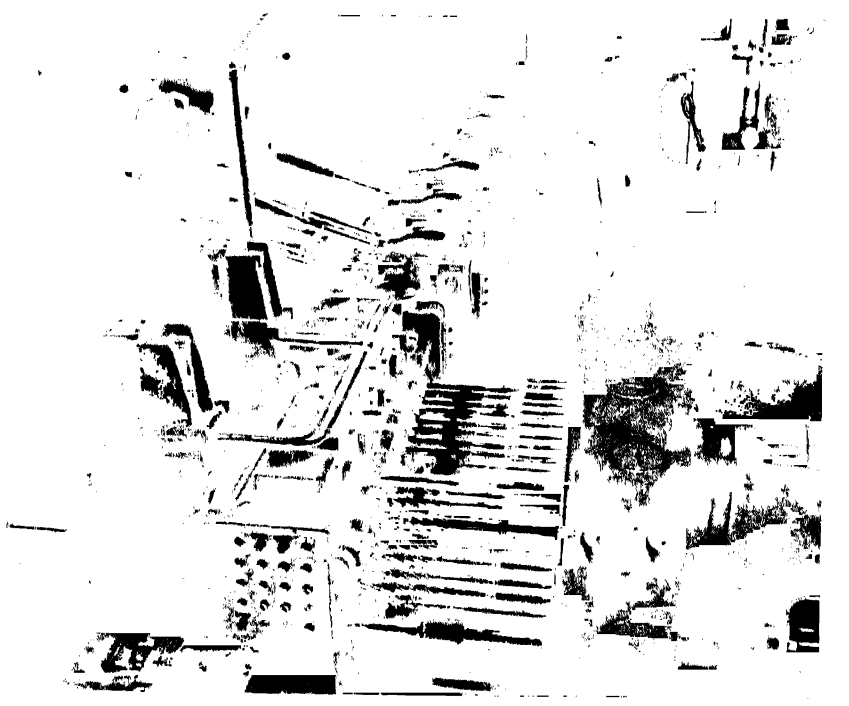
All drills are changed after a definite number of pieces have been drilled, regardless of whether or not they are still sharp.

Combination or segmental broaches are not disassembled at the machine. Both broach and holder are removed from the machine and sent to the toolroom. This insures that all sections will be ground equally, and to the same accuracy.

All machines are unit-head type. If at any time a change in engine design occurs, only the cast iron base

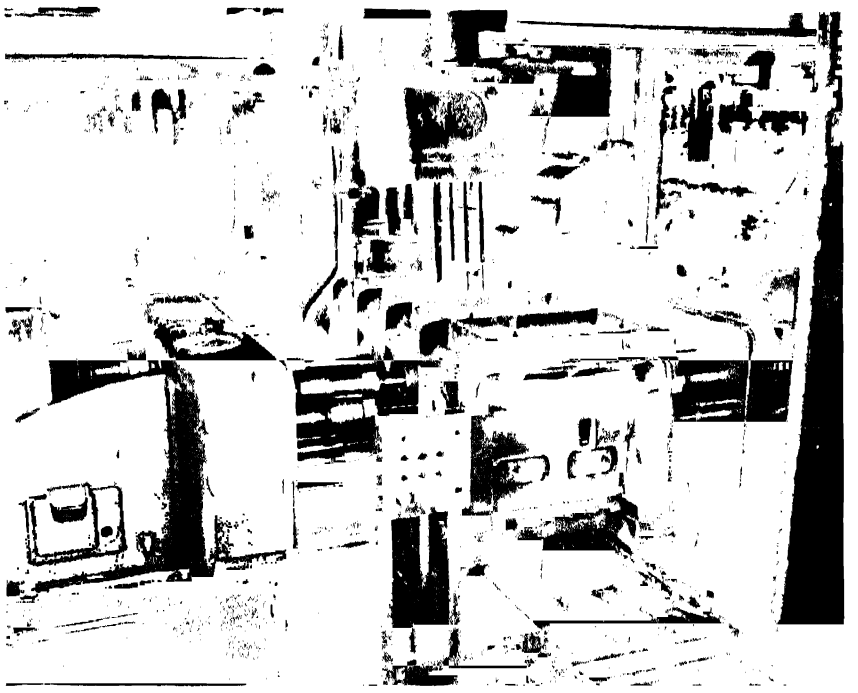


Both ends of two sizes of diesel motor crankcases are milled in this Newton duplex hydraulic milling and shaving machine. On the return stroke of the table both ends of the crankcase are "skived" to a straight and smooth finish. A similar machine is used to mill and finish top and bottom surfaces of the crankcases.

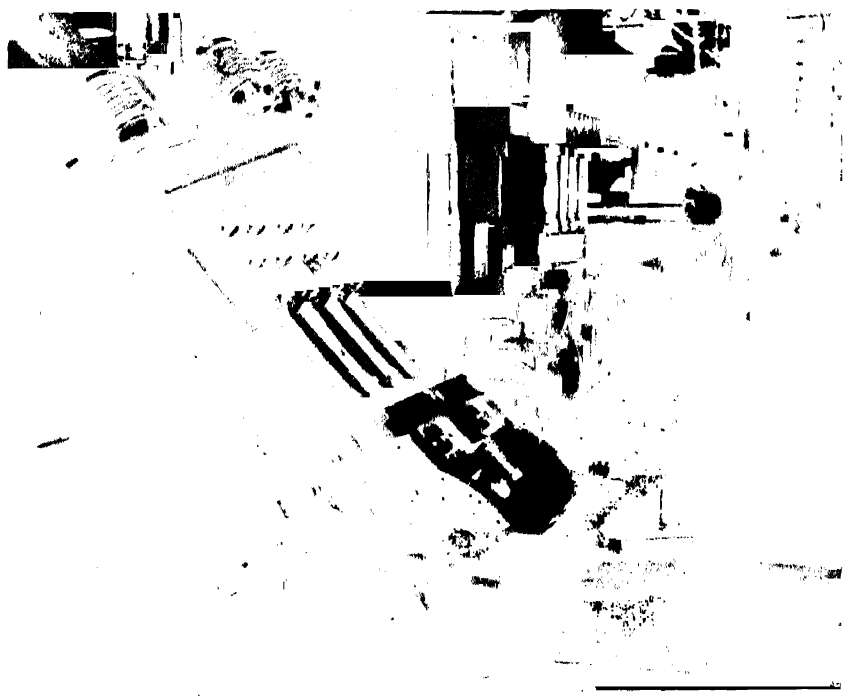


The first of a battery of special Greenlee horizontal machines drills and taps all the holes in the top and bottom of the crankcase as well as drilling and reaming some of the angular holes in the sides of the case. Operation is entirely automatic. Blocks are moved by hydraulically actuated pushers.

Production machines in the Milwaukee diesel engine shop just opened by International Harvester are interchangeably tooled for different units



The second Greenlee horizontal machine rough bores the camshaft bore, main bearing seats and drills all the holes in both ends of the crankcase Blocks are moved off the roller conveyor to a point where they are taken over by the hydraulically actuated transfer bar the catches for which can be seen at the machine end Blocks then are lifted to drilling position



A four-spindle Moline boring machine is used to semi-finish bore the crankcase for the dry liner cylinder sleeve They are finish bored on the four-spindle Ex-Cell-O precision machine shown in the foreground Bores are held within 0 0002 in for parallel and out of round

need be scrapped, the heads can be used again

Heat treating operations are placed in or near the line where needed rather than in a separate department.

For the first operation on the crankcase line the rough casting is clamped on the table of a Newton heavy duty machine for rough milling the top and bottom On the return stroke the same surfaces are finished by 'skiving without appreciable loss of time One long tungsten carbide blade is mounted at an angle to the vertical on the end of a hydraulic ram which moves into position to make this finish cut The finishes achieved are excellent as gasket surfaces The two ends of the crankcase are machined and skived' on another Newton milling machine

Various locating and other holes are drilled cylinder bores are roughed out and bearing seats and notches are straddle milled on standard tools

By gravity feed conveyor the crankcase then is delivered to a group of three special Greenlee automatic transfer machines operated from one master pushbutton control board These machines drill and tap the rest of the holes in the crankcase automatically except for the camshaft and crankshaft bores

The first of the three machines has fourteen stations for drilling and tapping top and bottom holes and some angular holes in the crankcase Holes in the ends of the block are drilled and tapped, oil pump hole bored, and oil gallery hole drilled through the full length of the block in the second machine which has fifteen stations The latter operation is accomplished in three steps one quarter through from each side at station two, one half through from one side at station three finished from other side at station four An eight station machine for the holes in the sides of the crankcase completes the drilling and tapping operations

The crankcases are moved along from station to station by hydraulically operated pusher bars, the progress of the work being controlled by a series of limit switches which are interlocked to provide proper sequence of operations Interspersed between the three drilling and tapping machines are automatic turnaround and chip unloading devices which require no attention Automatic washing machines timed in conjunction with the drilling machines are placed in the drilling and tapping lines

At various stations on the three machines automatic suction devices remove chips from the crankcase,

carry the chips to the roof of the building, and remove them from the roof by gravity conveyor to one common unloading spot outside the building. This prolongs the life of the machines, eliminates untidiness in handling chips, and produces some savings in costs.

Camshaft, crankshaft and oil pump bores are rough and finish machined simultaneously in a Greenlee machine, thus maintaining their relative positions accurately for precision results. Cylinder bores are rough-bored on a Moline machine and finish-bored on an angular-type Ex-Cell-O precision boring machine. Spindles on each are driven individually so that the boring heads need only be respaced to suit another size of block.

All machines in the crankcase line

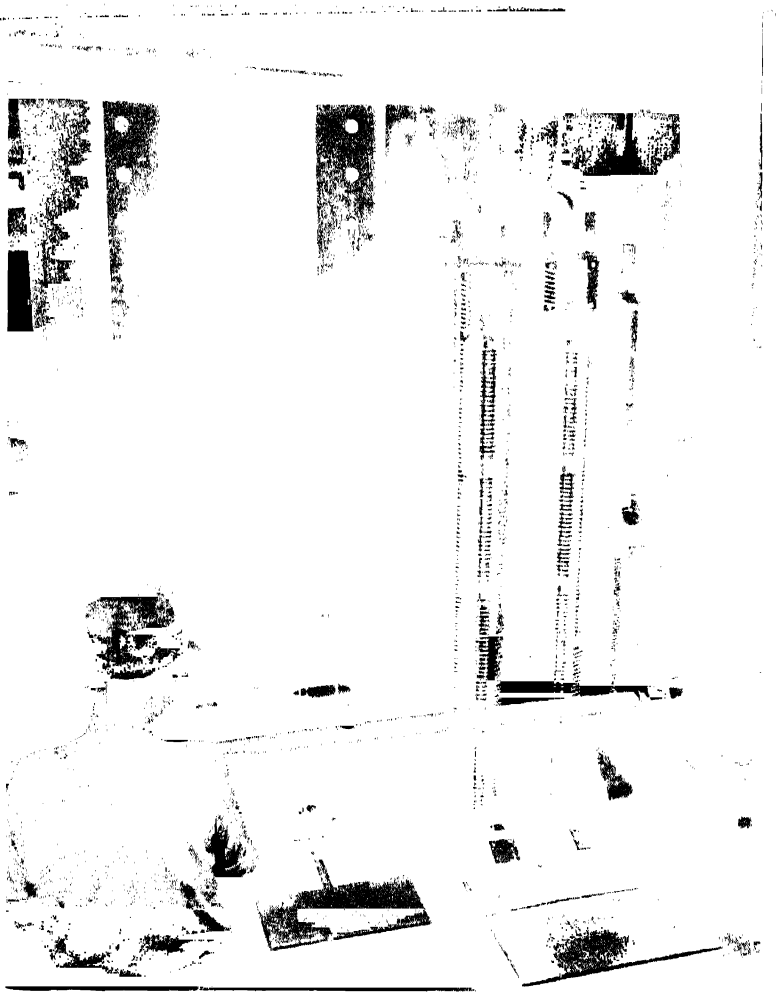


A chip exhaust system, developed by the Milwaukee Works, is installed at the end of the first Greenlee machine. All drilling chips are extracted from the crankcase by vacuum and are delivered into a receptacle on the roof

are automatic-cycle, pushbutton-control models with adequate safety devices. Throughout the line, no manual lifting, clamping, or trucking is performed. At no time is it necessary for a crankcase to be removed from a conveyor, even for inspection.

On the crankshaft line all shafts are handled on a 500-ft. endless overhead conveyor, which makes a complete circuit of the machines on the line. The conveyor cradles carry six crankshafts each. No trucking is done.

The crankshafts are Tocco-hardened and the latest type of Norton grinding equipment is used in grinding line and pin bearings. These machines are designed to maintain tolerances to within 0.0003 in. A Tinius Olsen crankshaft balancing machine is used to obtain both static and dynamic balance of crankshaft.



Sides of the connecting rods at both ends are straddle broached in this Oilgear 40-ton double slide machine. Connecting rod caps are straddle broached on one side and the back face and half-round diameter of connecting rod and connecting rod caps are broached on the other side. All clamping is automatic

An automatic Snyder machine drills, counterbores, reams and taps the flange holes in the crankshaft. On the other end the machine drills and reams two diametrically opposite holes in the stud end. This is a four-position machine with a lateral automatic index from front to rear, with automatic return to starting position when all operations have been completed.

All main and pin bearings are polished on a Schraner hydraulic polishing machine which is so flexible that it handles five different crankshafts. The inspector's test on this machine is made by the use of a flat piece of steel similar to a Johansson block, upon which a slight trace of Prussian blue is placed. After contact with the block, the crankshaft must show a trace of blue throughout the entire length of the bearing being checked. Periodic checks are made with a profilometer, smoothness being required because of the excessive loads imposed upon the diesel engines.

The first operation on the connecting-rod line is that of broaching the two sides of the crankpin, two sides of the wristpin, the half-holes, the caps, contact face and two mortise joints which hold the cap and rod together, and the back side of the rod, which is machined so that it may clear through the cylinder bores. The equipment used is a vertical twin-ram, 40-ton Oilgear surface broaching machine with two fixtures, having a shuttle motion in and out in sequence with two rams. All pieces are clamped automatically.

The crank bore is finish-ground on a Heald Guagematic machine which eliminates the possibility of a bell-mouthed bore. Distance between the two mortised joints on the cap contact faces is held to a total tolerance of 0.0005 in. The oil hole between the wristpin and crank bore is drilled on a Leland-Gifford "woodpecker" type drill press. Wristpin hole is diamond

bored on a two spindle Ex Cell O diamond boring machine

Balancing pads are provided at both the wristpin and crankpin ends of the rod, and the rod is balanced to within 0 2 oz in on a rise and-fall Snyder automatic balancing machine The connecting rods are thus held in balance from the beginning of production, an important factor in reducing future service problems

All connecting rods are carefully inspected in the forge shop for grain flow, trim marks and scratches and each rod is magnafluxed to guard against future fatigue failures

Cylinder heads are made of alloy iron with a high chrome content and are carefully checked for cracks flaws or blow holes, both before and during the process of machining

Tops and bottoms are rough and finish milled on a special Ingersoll drum type machine All holes regardless of angularity or position are drilled in multiple equipment of unit head type which is flexible enough to take care of any future designs An interesting machine in the cylinder head line is a special Oilgear broaching machine which presses in all valve guides simultaneously and then broaches and burnishes them on the inside for the valve stem The broaches fall through into a container beneath the machine

All pistons are turned on automatic lathes The wristpin hole is bored on an Ex Cell O precision boring machine All pistons are handled on conveyors, with a return conveyor underneath for empty trays

The outside diameter of the Lynite piston is not ground but is diamond turned on a special Sundstrand automatic lathe The finish and smoothness are claimed to be at least equal, if not superior, to the usual ground finishes Cast iron pistons are finished in centerless grinding machines

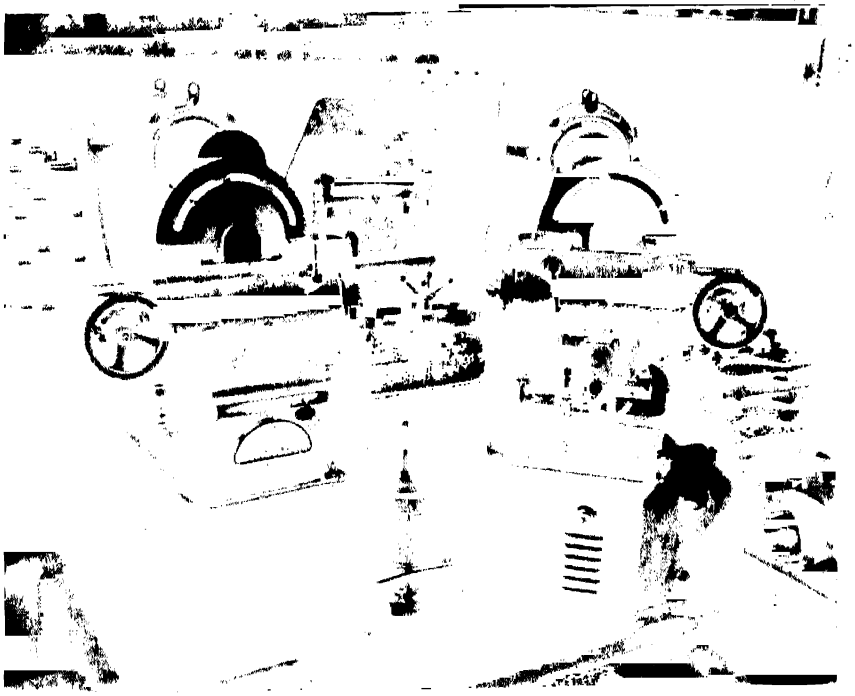
Cylinder sleeves used are hard dry liners They are rough bored on a vertical eight spindle W F & John Barnes machine Outside diameters are turned on automatic Fay lathes and they then are delivered to a gas furnace, which is installed adjacent to and as a part of the line, for heat treatment These sleeves are hardened to 45 to 55 Rockwell C

After heat treatment, the sleeves are reamed on a battery of Baker hydraulic drills with special equipment developed by Barber Colman the cutters of which have blades with inserted tantalum carbide tips

Special short gravity feed conveyors are placed between groups of operations so that no trucking is necessary Sleeves run on these conveyors on their own periphery The piston line and sleeve line converge at a common point where pistons, pins, and sleeves are fitted together



Two sizes of motor cylinder heads can be drilled in this Natco horizontal three way machine 1 TD 9 cylinder head is machined in the lower magazine while the 1 TD 6 head is drilled in the upper



Connecting rods are balanced on a Snyder machine Pads at each end of the rod can be milled off to the close limits required Total variation of 0 2 oz in weight of the four connecting rods in the diesel motor is maximum permitted

Among the miscellaneous parts manufactured in the new shop are oil pumps, oil pump covers, water pumps, drive pulleys, starting crank nuts and other small machine parts, as well as repair parts Such equipment as No 5 A Potter & Johnsons, Heald facing machines, and Monarch Fay and Gisholt lathes are used to machine a number of small parts A six spindle rotary type, Lees Bradner vertical machine is used for cutting timing gears It is so built that if one spindle requires repairs, the other five may still be kept in operation

How to use dressing tools

BY H. J. WILLS, ENGINEER THE CARBORUNDUM COMPANY

Dressing grinding wheels at regular intervals following a standard procedure is more economical than dressing when the wheel seems to be loaded

APPARENT VARIATION in the performance of grinding wheels of exactly the same specification frequently is due to variations in dressing practice For example, if a wheel is dressed with a dull diamond it will give the effect of a loaded wheel, and will act several degrees harder in grade than the specifications show

To get the greatest output with uniform results in production work, wheels should be uniformly dressed at regular intervals, regardless of the apparent need Any saving in time from infrequent dressing is more than off-set by reduced production and shortened wheel life

For any job, the wheel should always be dressed in a manner determined by tests as the best procedure For instance, the frequency of dressing, rate of traverse and depth of penetration should always be the same for a given job Only carefully recorded tests will show the best method to be used

For precision grinding and the production of fine surfaces, wheels should be balanced before and after truing New wheels may be somewhat out of round when mounted When balanced in this condition they will run out of round, but after truing this false balance is destroyed and the wheel must be rebalanced Also wheels that are in good balance at grinding speed may become out of balance at higher or lower speeds A wheel that has been trued wet must be dried before rebalancing, since the nature of the out of balance is sure to be affected by the moisture in the pores of the wheel

Traverse lines on the work often are caused by the dragging edge of a wheel If the wheel is not grinding to a shoulder, dragging can be prevented by rounding off the edges with a dressing tool or hand stone If necessary, finish the rounding with aluminum oxide paper This also will prevent the tool from chipping the edge

Scratches on the work often are caused by abrasive grains which have been loosened, but not removed from the wheel When the wheel face comes in contact with the work, these grains roll between the work and the wheel Loose grains can be removed by scrubbing the face and sides of the wheel with a stiff bristle brush and clean water after each dressing

Faulty dressing or truing may result from performing these operations at a point on the machine away from the grinding position This may be due to the fact that the ways of the machine are worn more at one point than the other, and is a frequent cause of dragging edges Dressing with the tool exactly on the axis line of the wheel will help

It usually is a mistake to dull the

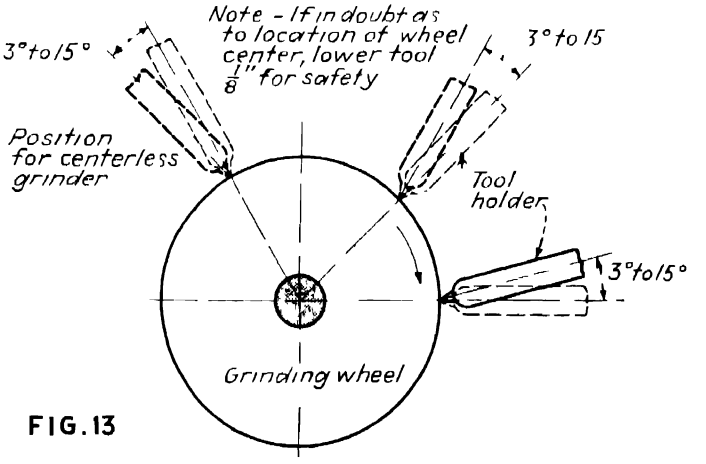


FIG. 13

FIG. 14

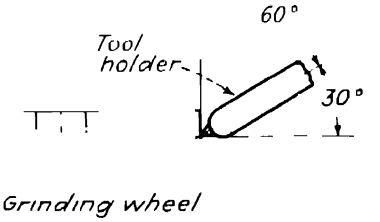


Fig. 13—For best results, the diamond dressing tool must be set up at an angle with the wheel face as shown. Never set the stone above the radial line of the wheel, or chattering and gouging are to be expected Fig. 14—To avoid diamond marks on the wheel, set the tool at 60 deg with the face of the wheel in the horizontal plane

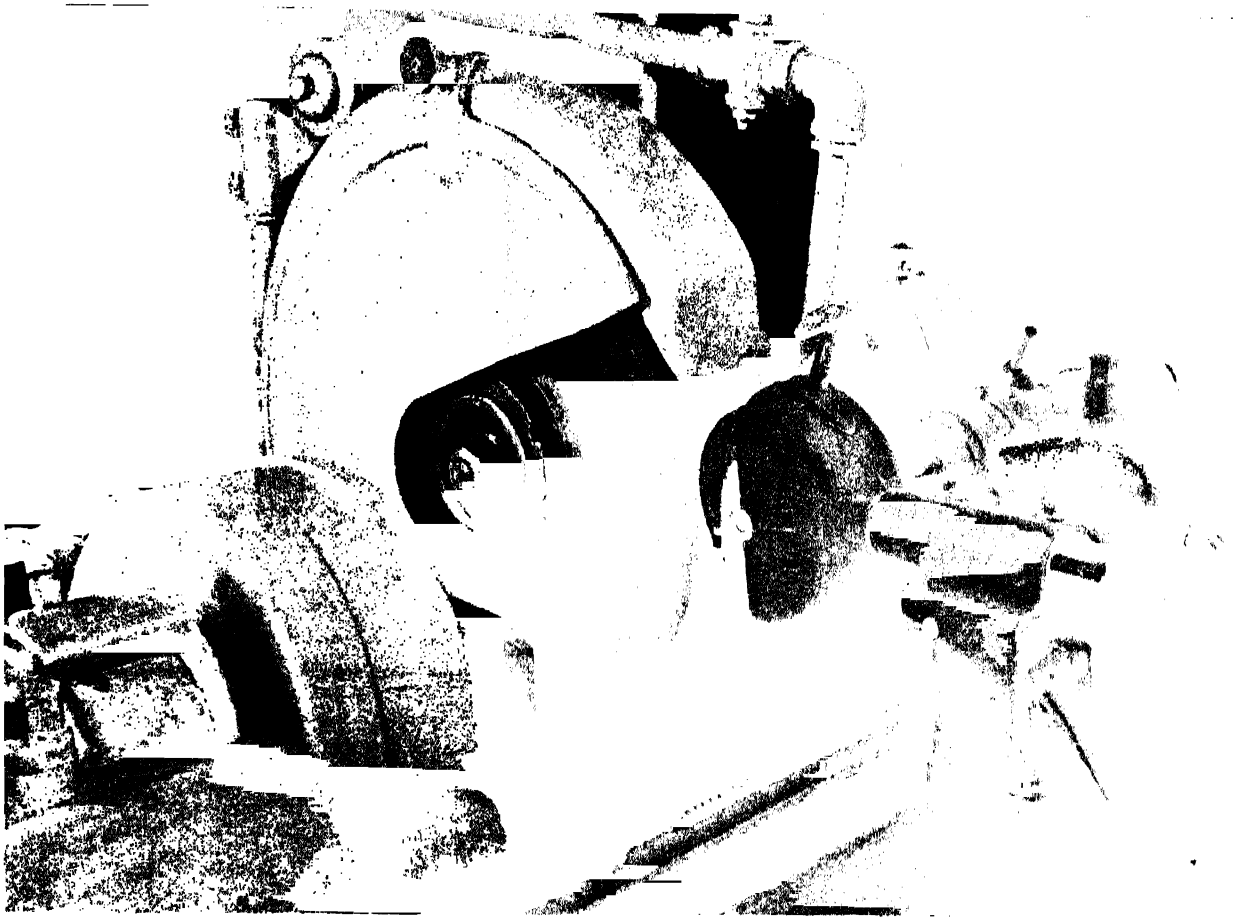


Fig. 16—Abrasive wheel dressers usually are set at 5 to 7 deg. angle with the axis of the grinding wheel. Dressing wheel grit and grade should be such as will hold a straight cutting face across the grinding wheel face

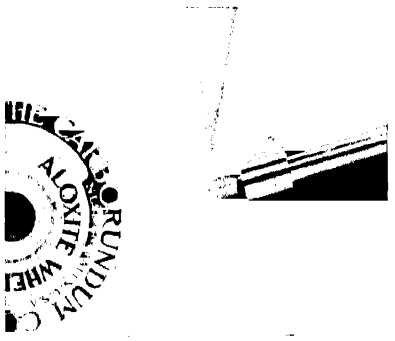


Fig 15—This photograph indicates the correct position of diamond dresser and coolant nozzle for proper wheel dressing

face of a wheel for the final passes. The burnishing action which results gives a pleasing finish which may be covering a poorly generated surface. The best surfaces are built up by grinding with a succession of wheels of diminishing grit size, all of which are sharp enough actually to cut.

If a wheel is used for wet grinding, dress it with coolant, and vice versa. If a wet grinding wheel is dressed dry, the pores will retain some of the coolant and the cuttings will adhere to the face, to become loose and cause scratches. A grinding wheel that is dressed wet will become gummy when grinding dry.

Unless the coolants used in grinding and in dressing are clean, the particles of foreign matter will roll between the wheel and work, scratch the work and score the wheel face, thus necessitating more frequent dressing. The number of pieces per dressing can be increased materially if an efficient filter is installed in the coolant system.

If dressing were merely for the purpose of removing material from the wheel face, a Huntington "star" dresser would do the work best. For a wheel to be sharp enough for precision grinding, the abrasive crystals must be completely fractured and project above the bond. This can be accomplished only with a sharp diamond.

A dull diamond will crush some of the grains down into the bond, and partially break others. These will break away in operation, come loose and roll between the work and wheel.

A wheel dulled by a dull diamond will act harder than its actual grade. This dulling often is so gradual that it is not immediately apparent. Production suffers, and when the wheel is finally dressed with a sharp diamond it acts much softer. To get consistent production and finish it is essential to sharpen the wheel frequently with a sharp diamond.

To prevent chattering of the diamond tool and to eliminate the possibility of gouging the wheel face and damaging the stone, the tool must be at an angle with the wheel face in the vertical plane, as shown in Fig. 13. This is done by first setting the diamond holder on the radial line of the wheel, with its side parallel to the side of the wheel. The rear end of the tool then is raised to make an angle between the tool axis and radial line of the wheel from 2 to 15 deg.

Keep Close to Radius

If there is any doubt as to the exact radial line of the wheel, drop the point of the tool slightly, not more than $\frac{1}{4}$ in. below the supposed radial line. This is to prevent any chance of the point being above the axial line, which would cause it to gouge the wheel, and probably break the

stone By rotating the stone in its holder at frequent intervals, this setting maintains a sharp point on the diamond However, the point may cause diamond marks on the wheel

To avoid such marks, the holder should be set an an angle of 30 deg to the tool axis in the horizontal plane, that is 60 deg to the face of of the wheel, as shown in Fig 14 This setting wears a sharp, broad edge on the diamond, which will dress the wheel openly, without threads Turn the diamond frequently to maintain sharp edges

For ordinary grinding it is satisfactory to contact the stone at the highest part of the wheel, supposing the wheel to have been worn convex or tapered For high finish grinding however the best practice is to bring the diamond nearly into contact with the wheel start the traverse and feed in 0 001 in at the end of each pass until contact is made Never spot a diamond on the face of a fine grit wheel

Unless the stone is set in a special tool whose settings are designed to be ground away as the diamond wears it is poor practice to grind into the setting This is because ordinary tools are designed to expose the greatest possible amount of stone Grinding into the setting will weaken the hold on the stone and damage or complete loss is apt to result

The diamond dressing tool is a precision tool of considerable delicacy If good grinding is to be done, and excessive diamond cost avoided, it is necessary to observe certain precautions

Unless a stone of the correct size is used diamond marks may appear on the wheel There will be too rapid diamond wear and possibly a broken diamond if the stone is too small Choosing a stone of the right size is an important factor in keeping diamond costs down

Support Dresser Rigidly

Make sure that the stone is properly set, otherwise it may come loose or break or cause chatter or gouge marks on the wheel If a stone is cracked, burned or shows flat spots discard it Otherwise, you may get chatter marks and a dulled wheel face Both diamond and wheel costs will be too high

Chatter and diamond marks gouging and diamond breakage may result if the mounting tool is not rigidly supported with minimum overhang and in the proper location and angle Sharp angled stones (splinters) should not be used for high finish grinding as they cause marks which can be removed from the wheel only by the expenditure of excessive time for smoothing the wheel face Unless plenty of coolant is used when dressing, or in dry grinding ample time allowed for cooling, the stone may burn, break or come loose in the mounting Shocks are apt to break the stone Diamond cuts should not exceed 0 001 in in depth if marks are to be avoided and economical diamond costs achieved

Abrasive wheel dressers are applied to the grinding wheel at an angle from the vertical The greater the angle the more open the resulting grinding wheel face The usual angle is from 5 to 7 deg Since deeper infeeds and coarser dressing wheels give more grinding wheel faces, it is evident that by changing angles infeeds and grits a variety of dressing effects can be secured with abrasive wheel dressers Thus with a given dressing wheel it is possible to secure finer and consequently slower grinding action by lightening the cuts and decreasing the angle

Traversing the dresser without infeed causes glazing, regardless of



traverse speed In traversing do not allow the dresser wheel to pass off the grinding wheel When that happens the dresser loses speed and when it again contacts the grinding wheel at lower speed the grinding wheel will be gouged Also, when the dresser is allowed to run off the face of the grinding wheel even partly the contact area is decreased the penetration increases due to the greater unit pressure and the edges of both wheels may be rounded or even broken However if traverse lines are present they may be eliminated by allowing the dressing wheel to pass off the grinding wheel

Dressing wheel grit and grade should be such as will hold a straight cutting face across the entire grinding wheel face If an abrasive wheel dresser gives an irregular dressing action or fails to true a wheel, the cause probably is that the dressing wheel itself needs truing Its errors may be dressed into the grinding wheel The less the angle between the wheels, the more the trouble is exaggerated To true the dressing wheel take a light cut against the grinding wheel with an angle of 10 to 15 deg

Incidentally, the abrasive wheel dressing tool depends for its accuracy largely upon the accuracy of its bearings A slight bearing imperfection will be multiplied on the grinding wheel as chatter and out of roundness

Although it is desirable to use coolants with the abrasive wheel dresser, general practice is to dress dry When this is the case both wheels should be thoroughly flushed with clean water after using the dresser

Double Dressers

Hard bond grinding wheels, those with wide faces, and some silicon carbide wheels tend to chip the dressing wheel edges and to taper them This can be overcome by equipping the dresser with two wheels instead of one Each wheel is $\frac{1}{16}$ in less than one half the width of the single wheel They are separated with a standard blotter This doubles the number of cutting edges and smoothing faces The two cutting edges at the center are applied to the grinding wheel at the point of greatest pressure where formerly there was only a smooth surface Such two wheel tools can be used at slower traverse speeds and lighter feeds, which gives a better face to the grinding wheel for finish cuts The angle is the same However with double dressing wheels it is necessary to use plenty of water when dressing

To dress wheels for semi roughing (63 to 1,000 micro inches) the abrasive dressing tool should be traversed at about 40 in per min with a feed of 0 002 to 0 003 in per pass

For wheels to produce commercial surfaces (8 to 63 micro inches) use 40 in per min traverse for a few passes at 0 002 to 0 003 in feed per pass Then reduce to 20 in per min traverse with 0 001 in feed for several passes Too many passes may smooth the wheels too much

For wheels that are to produce medium fine surfaces (4 to 8 micro inches) use the procedure for commercial surfaces, followed with the same feed at 10 in per min traverse The final pass is made without infeed of the dresser

For fine surfaces (1 to 4 micro inches) use the method given for medium fine surfaces but use a water coolant for all stages of dressing, and set the tool at a smaller angle Never let more than one third of the dressing wheel face pass off the grinding wheel

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The third and final article of this series by Mr Wills will appear in an early number

Carbides for cutting steel

BY PHILIP M. McKENNA, PRESIDENT, McKENNA METALS COMPANY

Ever since tungsten-carbide tools proved their worth on cast iron, metallurgists have sought a similar material for use in machining hard steels

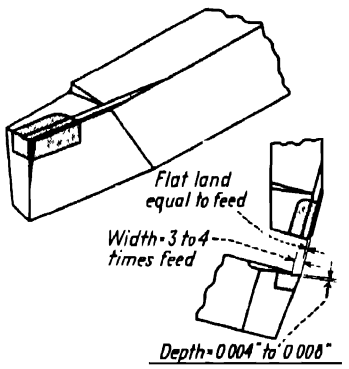


Fig. 1—When turning most steels above 0.35 carbon and harder than 250 Brinell, this tool will produce short, coiled chips

PROPERTIES required in a cemented-carbide for resisting "cratering" from tough, hot, swiftly moving steel chips and for resisting breakage from interrupted cuts, are entirely different from the hardness and heat conductivity needed for machining abrasive materials of lower tensile strength. The search for a tool metal for cutting steel at high speeds led to the development a few years ago of a crystalline intermetallic compound, a double carbide of titanium and tungsten, corresponding to the chemical formula $WTiC_2$. This compound made it possible to produce a metal which effects economies for steel-cutting that are similar to those effected by tungsten carbide when used for cutting cast iron and brass. These two carbide tool materials should not be confused. They have different fields of usefulness, and are used in tools of differing shapes.

Produced in grades containing varying proportions of the compound $WTiC_2$, these compounds are harder than the hardest tool steel (67 Rockwell C), and have strength in cross rupture which approaches that of high-speed steel. Thermal conductivity is about the same as for tool steel or two and a half times as great as that for tungsten carbide. Compressive strength of these compounds is high, up to 690,000 lb. per sq.in. They are not so rigid as tungsten carbide compositions, having a Young's modulus of about 58,000,000 lb. per sq.in. compared to 80,000,000 for tungsten carbide. This point is of practical significance when taking intermittent cuts on rough steel forgings or castings.

Turning Tools for Steel Parts

For turning bars or smooth forgings in engine lathes or turret lathes, right-hand tools, such as the one shown in Fig. 1, are preferable. Such tools should have chip breaking grooves, which are effective at depths of only 0.004 to 0.008 in. The slight interruption to the flow of chips caused by these grooves curls the chips into short coils which break off into lengths easily removed from the lathe pan for most steels above 0.35 car-

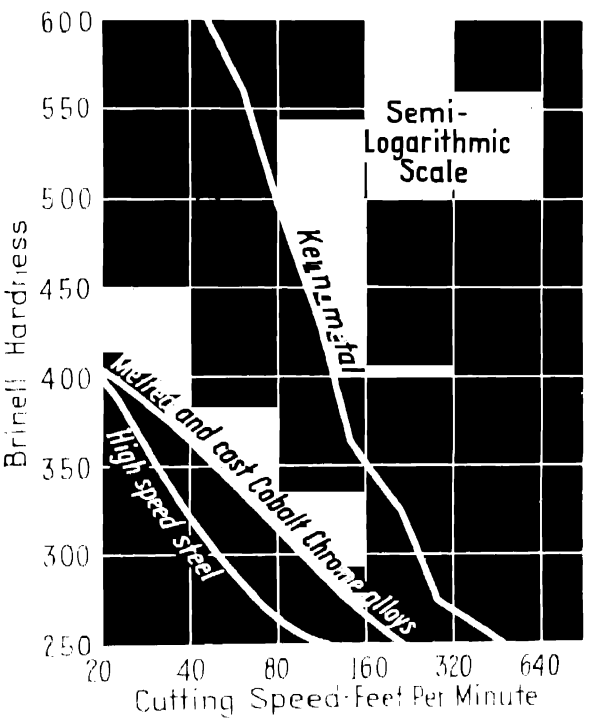
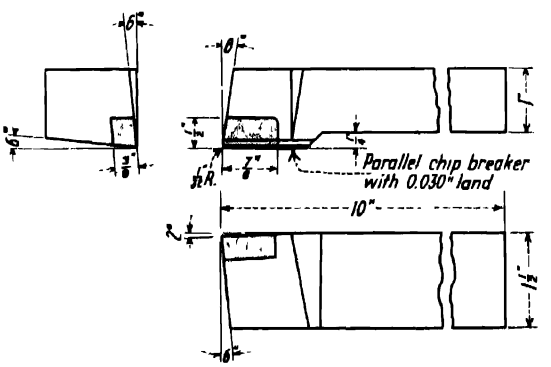


Fig. 2—Comparative chart of machining speeds with single-point tools on commercial steels, such as SAE 1015, SAE 3140 and SAE 4320, of varying degrees of hardness

Fig. 3—Employed for turning against a 90 deg. shoulder, this tipped tool has a zero side cutting edge angle. It will not last as long as a tool having a 15 deg. lead angle



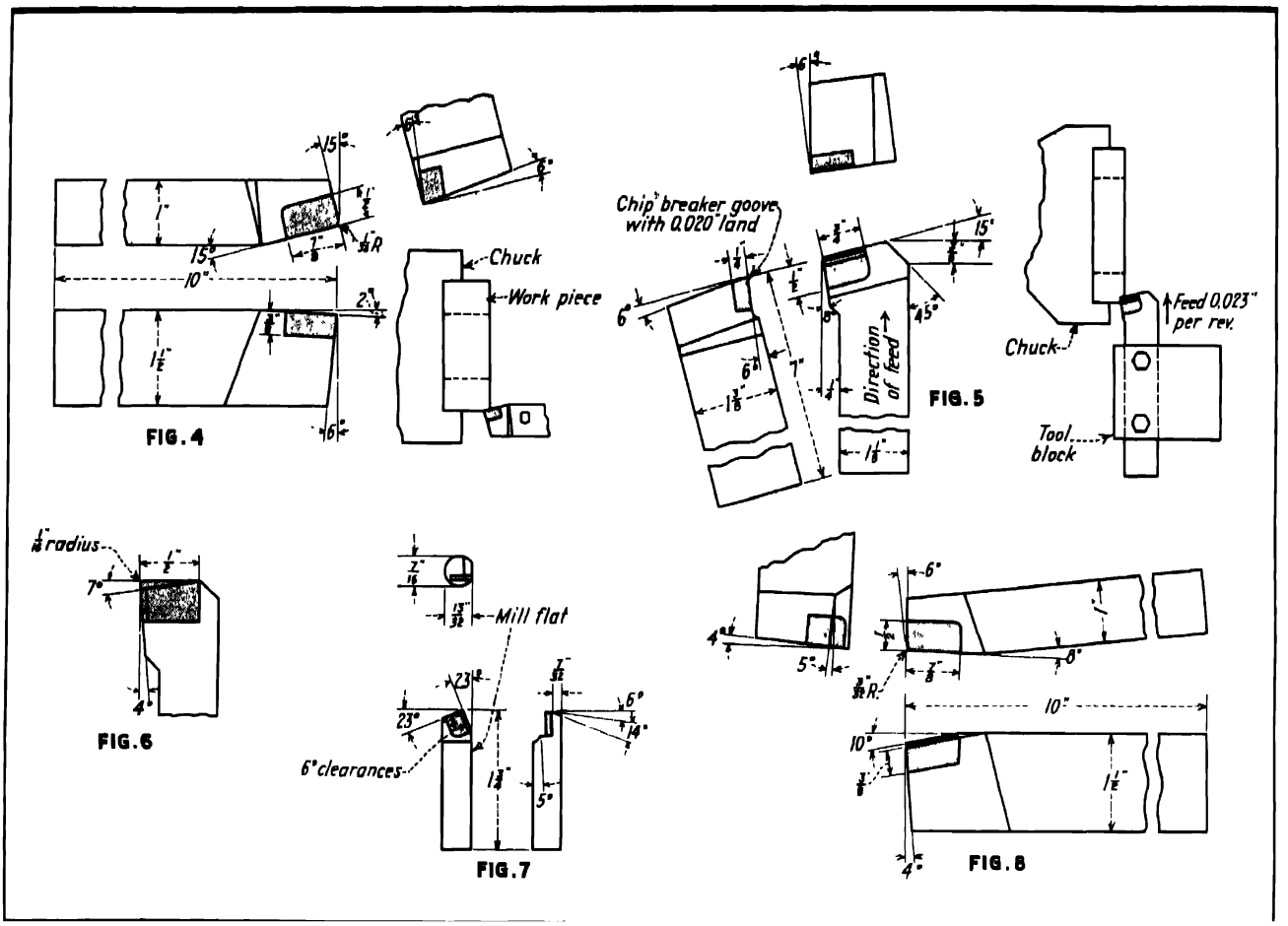


Fig. 4—This carbide-tipped tool is suitable for many facing cuts in steel. A chip-breaker groove is not necessary for most facing operations. Fig. 5—Used in turret lathes for facing gear blanks, this tool has a chip breaker groove along the cutting edge. Fig. 6—This facing tool, having a chip-breaker groove at a 7 deg. angle with the cutting edge, can be used when facing to a 90 deg. shoulder. Fig. 7—Tools of this design set at 75 deg. from the axis of the boring bar are suitable for boring long holes in steel tubes. Fig. 8—Recommended for planing and shaping operations, even with "jump" cuts, this carbide-tipped tool has negative side and back rake

bon and above 250 Brinell in hardness. A flat land, or in some cases a land having a two-degree negative rake, made equal in width to the feed per revolution is provided along the cutting edge.

Speed of cutting varies with the hardness of the work-piece. In Fig. 2 is plotted on semi-logarithmic scale the recommended speeds for cutting steels in various degrees of hardness. This chart also shows comparable speeds possible with other tool materials. Steel-cutting carbide tools do not operate efficiently at the speeds used for machining steels with tungsten-steel tools. To cut cleanly and smoothly with minimum of built-up edge, they must be run at two to six times the speed of high-speed steel tools on the same work.

For work where the chip is tougher, and not hard enough to break with the chip breaker design shown in Fig. 1, a shelf-type chip breaker may be employed. In this design, the groove is extended to the cutting edge as a "shelf" which is at a large angle with the side cutting edge. The terrace up which the chip must run deflects it sharply against the unturned shoulder of the bar, snapping it off in short fragments.

For turning against a 90-deg. shoulder, a tool such as that shown in Fig. 3 may be employed. This tool has a zero lead, or side cutting edge angle and has a parallel chip breaker groove with a land on the cutting edge having a width equal to the feed employed when using the tool. It should be noted that where it is not necessary to form a 90 deg. shoulder in turning, the tool shown in Fig. 1, having a lead angle of 15 deg., gives greater tool life.

Facing Cuts in Steel

For facing cuts on steel parts, the tool shown in Fig. 4 may be used to advantage. It is similar in design to the tool shown in Fig. 1, except that it is of the opposite hand. The shorter cuts commonly required in facing present less difficulty in disposing of chips. The tendency of chips to break due to changing speed as the cut proceeds from the periphery to the center of the work piece also helps dispose of chips on facing cuts. For this reason, chip breakers often are not necessary on short facing cuts. The lower speed near the center of the work reduces the efficiency of cutting. A variable speed drive on the lathe which permits a speeding up toward the center of the work will provide greater cutting efficiency.

Another common form of facing tool, designed for use in Warner & Swasey or Gisholt turret lathes for facing gear blanks is shown in Fig. 5. When facing to a 90-deg. shoulder with a radius, a tool as shown in Fig. 6 may be used. This tool has a chip breaker at an angle of 7 deg. with the cutting edge. The radius on the tool will be satisfactory when ground to

a templet, with clearance all around under the cutting edge.

For boring large diameter work, such as locomotive tires and large rolls in Bullard, King, Niles and similar mills, tools similar to that shown in Fig. 4 may be used. On large work these tools do not require chip breakers. For boring long holes in steel tubes, with round tools held in a boring bar, tools set at 15 deg. from a right angle to the bar (75 deg. from the axis of the bar) may be used. They should be shaped somewhat like the tool shown in Fig. 7.

Carbide-Tipped Boring Tools

Precision boring tools for such machines as those made by Heald and Ex-Cell-O are used with steel-cutting carbides, both for plain bores and for bores having interruptions, such as oil holes or slots, in the smaller sizes. Solid rounds of carbide often are used instead of tipped tools. They require careful grinding for clearance, often employing compound clearance angles, or preferably circular clearance. High negative back rakes, often as much as 40 deg. negative, may be employed in combination with positive side rakes of as much as 25 deg., going over interruptions with high tool life. These tools should be ground on special machines arranged to generate the clearances and rakes automatically on diamond wheels or laps.

Since the introduction of high-strength steel cutting carbides, many shaper tools tipped with this material have been used on steel castings and die blocks too hard to be shaped with high-speed steel tools. There is little to gain from using a carbide tool for shaping or planing soft steel under 302 Brinell, but in cases where a die block or casting must be shaped in the hard condition, these tipped shaper tools are invaluable. They also are recommended for machining cast iron in which hard spots are encountered, since these spots cause rapid dulling of high-speed steel tools.

Interrupted cuts are no obstacle when the tool is ground with double negative rakes as shown in Fig. 8, which is recommended for all shaper and planer work. Light cuts and feeds at the higher speeds available on planers or shapers, usually 80 to 100 ft. per min., are preferable. The combination of negative back rake with negative side rake angles used on these tools would not be practical if the tool material did not have non-galling characteristics. Steel castings and other parts having interruptions which cause breakage of the more brittle tungsten-carbide tool materials are often machined in shapers and planers with these tipped tools to advantage, especially where steel tools wear and lose size rapidly.

Carbide-Tipped Form Tools

As a simple example of successful form tools tipped with steel cutting carbides, Fig. 9 shows a tool with an internal radius for forming small bearing races of SAE 52000 steel. Also tools having internal radii are supplied for machining Nitroloy steel airplane gear blanks.

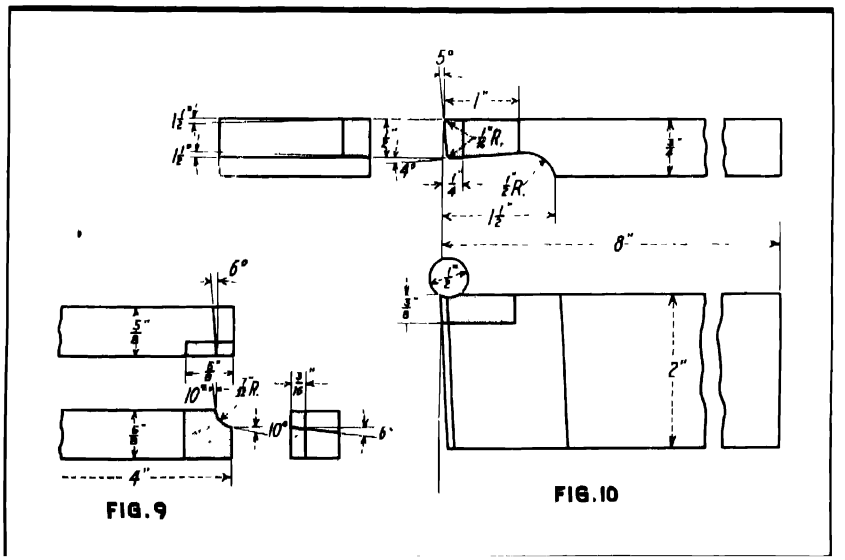


FIG. 9

FIG. 10

Fig. 9—Carbide-tipped form tools are satisfactory for forming parts made from SAE 52000 and Nitroloy steels. They must be ground on the profile with diamond wheels. Fig. 10—This carbide-tipped tool was developed to cut off steel shell forgings 4 to 6 in. in diameter with up to 1½ in. wall

The usual dovetailed tangent cutting form tool has been used successfully with a steel-cutting carbide blank brazed along the top. The form is ground into this blank. Since back rake is not used when cutting steel with this material, computations of forms are simplified, although the hardness of the metal makes diamond wheels necessary for profile-grinding the form. Form tools of carbide should not be used where the steel to be form turned is soft enough to cut readily with the more easily ground tungsten high speed steel or cobalt-chrome alloy tools, or where automatic screw machines are incapable of the higher speed required.

Cut-Off Tools

Certain types of cutting-off jobs on steel are done satisfactorily with tools tipped with these carbide materials. These include those where a blade wider than ¼ in. may be employed, and those which do not cut off to a dead center, as in tubing or forgings with a central hole. These limitations are due to the tendency to weaving on narrow blades, and the low peripheral speed as the tool approaches the center of the work. Shell forgings 4 to 6 in. in diameter with walls 1 to 1½ in. thick are cut off with a tipped tool such as that shown in Fig. 10. In this particular operation it has been found more practical to leave about $\frac{1}{32}$ in. wall, to be broken off by a hammer blow when the work is removed.

The hard steel-cutting carbides may never be ground with wheels customarily used for grinding steel tools, as they are invariably cracked or surface checked on ordinary wheels. Manufacturers of grinding wheels have produced special loose-bond silicon carbide grinding wheels which are suitable for free-hand grinding, constant motion of the tool being essential. Another essential is the use of a *star* dresser every few minutes, since these wheels grind only by constant exposure of freshly fractured abrasive grains. Wear of silicon carbide wheels is rapid, and despite the greater initial expense, diamond impregnated Bakelite-bond wheels are cheaper in the long run, whether the tools are ground free-hand or in a fixture.

Economy in grinding carbide tools requires that as little grinding of the steel shank as possible be done with the special wheels; surplus steel shank to form the clearance should be milled or ground away on wheels better adapted to removing steel cheaply. It is advisable to spare the diamond

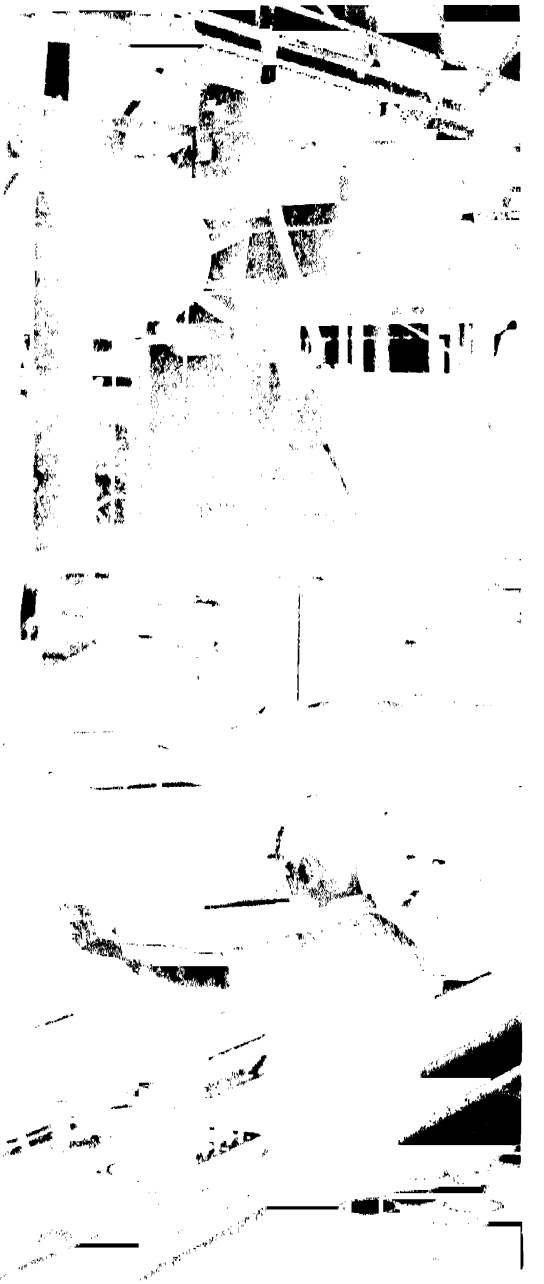
Shop Kinks



Time is saved in final reaming of cylinder liner seats, left, by this air-driven device suspended above the engine block conveyor line. A welded frame supports the air motor for driving the cutter bar. On the same shaft is the screw which feeds the reamer. Slots inside the frame permit the motor to feed down. Studs in the block serve as guides and hold-downs for the machine, which removes about 0.015 in. in the final operation. Below, inspection gage is suspended by a spring-balance at the left. Caterpillar Tractor Company

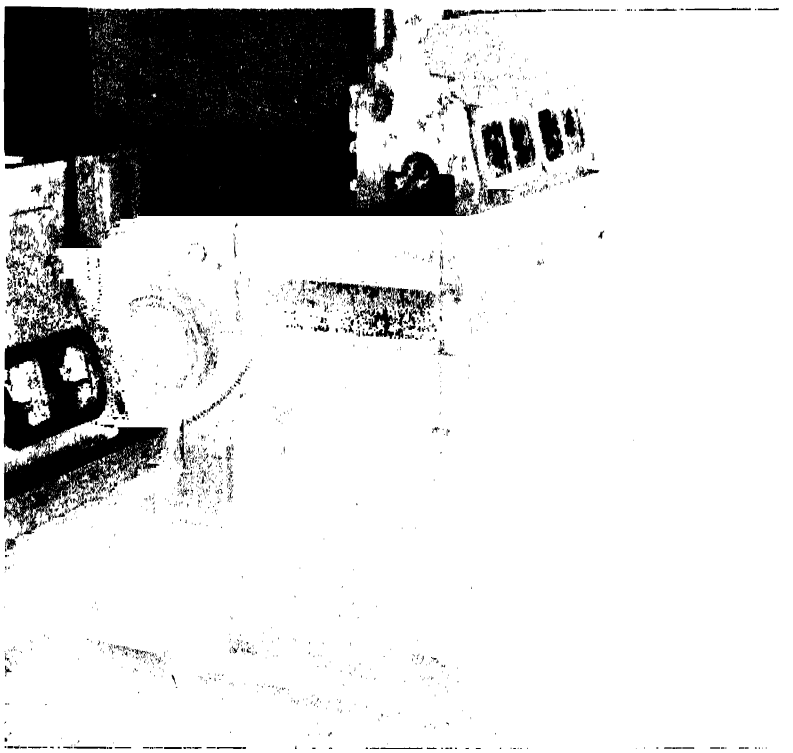


Fastening small parts to a milling or duplicating machine table is made easy with blocks fitted with T-slot hold-down bolts. Through each block pass two diagonal setscrews, which bite into the work and prevent it from creeping up





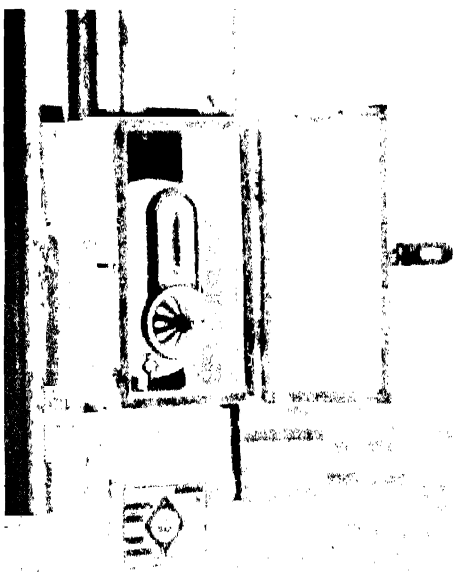
Blueprint wear is reduced greatly by backing shop prints with chip board, which can be obtained from most printers. One side of the board is covered with library paste, after which the blueprint is pressed on, using a photographer's roller squeegee to smooth it. After drying, both sides are given a thorough coating of white shellac. Dumore Company

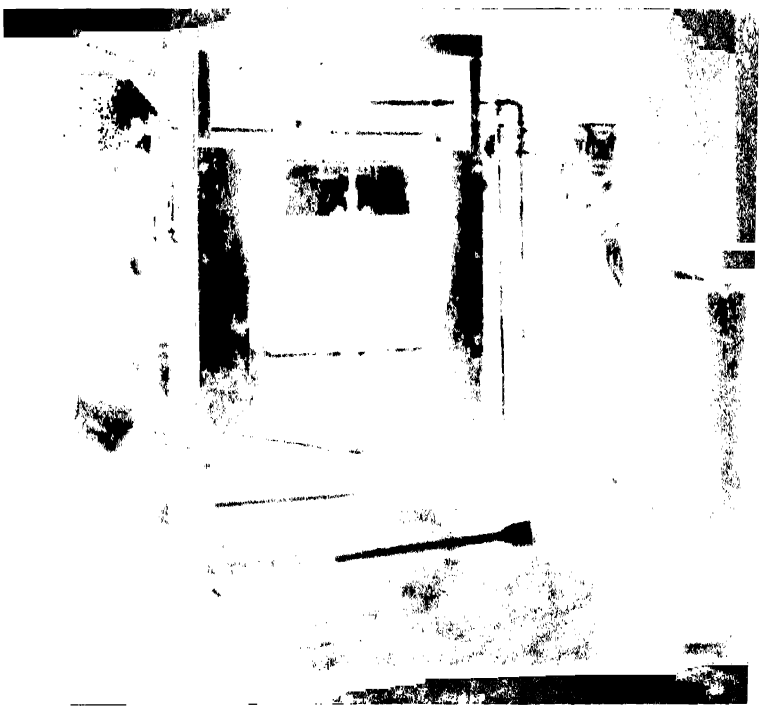


Lifting engine blocks from one level to another is easier with this self-contained hydraulic unit. Motor and constant-speed hydraulic pump are mounted on top of the welded reservoir. Oil flow to the cylinder which lifts this conveyor section is controlled by the pedal in the lower right-hand corner. Round bars at the four corners of the device serve as guides. Caterpillar Tractor Company

To insure proper quench without distortion of the small ends, chisels made of 0.75 carbon steel are rolled down a ramp into the brine tank, thus immersing all portions almost simultaneously. Ramp sides are made of two long steel rods bent to give a total height of about 12 in. Independent Pneumatic Tool Company

Protection of thermostats from accidental blows and other damage is given effectively by a wire mesh cage. Large mesh should be used to permit free air circulation for best thermostat operation. George Gorton Machine Company



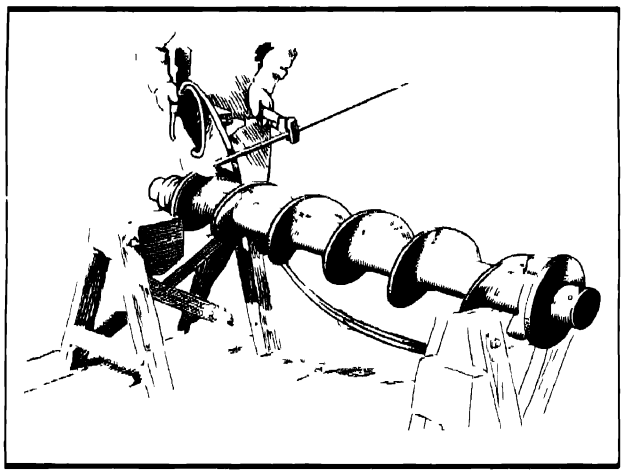


IDEAS FROM PRACTICAL MEN

Reclaiming Locomotive-Stoker Screws

By ARTHUR HAVENS

Stoker screws are seldom too badly worn to be reclaimed. Sometimes the flight of the screw, originally over ½ in. thick, is worn to a feather edge. In reclaiming Duplex elevator screws, the usual procedure is to turn off the flight of the screw until it



Duplex stoker elevator screws worn to a feather edge can be rebuilt by flame cutting the flight 1¼ in. undersize, tack welding a ⅝-in. steel strip along the flight, and welding the faces of the flight to the required thickness

is 1¼ in. under its original size. This allows the operator to fashion a bar of ⅝ in. square steel along the outside edge of the flight, thus returning the flight to its original size. By keeping this square bar tight against the flight it will be unnecessary to machine the periphery of the screw when the welding is completed.

The ⅝ in. square bar stock is cut into pieces about 6 ft long—this to facilitate handling One end of the bar is tack welded to the extreme end of the flight at the bottom of the screw and flush with the bottom of the flight The screw is then laid horizontally on horses and blocked so that it will not roll and the bar stock is heated with a welding torch so that it will bend easily to the shape of the flight. The operator will notice that it requires a slight twist in the bar stock to keep it at right angles to the screw. It is best to tack weld the bar stock to the flight at about 10 in. intervals.

After the bar is tack welded to the flight, enough material is added to build the screw up to required thickness. The welder can use a fairly large welding head and can use as many as two 5/16-in. rods at one time.

The Duplex conveyor screw presents a slight problem due to its length and varying diametrical sizes. It is very difficult to turn this screw down to size for the application of the steel bar to the edge of the flight. The easiest way to gain this end is to secure the screw in a lathe as if it were going to be machined, then fasten a cutting torch to the tool post and as someone turns the chuck by hand, manipulate the hand feed on the carriage so that the torch will follow the flight of the screw. A neat and suitable surface will result, and the bar stock can be tack welded to the conveyor screw. Since the conveyor screw is longer than the elevator screw, it is difficult to handle while welding. A splendid idea on this is to cut one head from a second-hand locomotive main reservoir and sink it in the floor, leaving the open end flush with the floor. The long conveyor screw can then be held over this open end by a crane or hoist, and as the welding progresses the screw can be lowered into the reservoir.

Due to the varied sizes on the Standard stoker elevator and conveyor screws, it is not possible to prepare the screws for a square strip by turning. In this case the flight is carefully calipered and a piece of round stock sufficient in size to return the screw



Short stoker screws can be set vertically on the floor for welding the flight to the required thickness. Conveyor screws can be lowered into a pit by crane as welding proceeds

to its required size is tack welded to the edge of the flight. However, if the wear is less than ¼ in. it is built up with welding rod. The part of the conveyor subjected to the most wear are those flights in the crusher zone; therefore, these will be found to be in much worse condition than the balance of the conveyor. Sometimes this is the only part worn enough to require rebuilding, and for this reason, hard surfacing is recommended. The teeth on the crusher itself come in for their share of wear. They should be rebuilt with wear-resisting material.

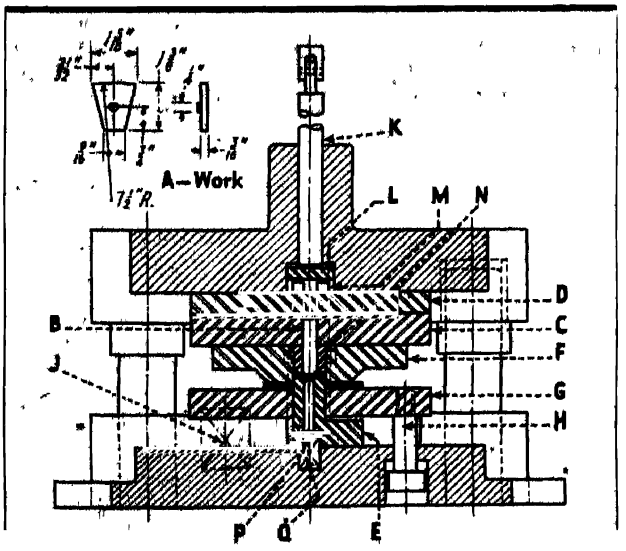
Press Tools for Embossing and Blanking

By WILLIAM B. GREENER

The press tools illustrated were designed for embossing and blanking a large quantity of parts from scrap stock, such as the one at *A*

The tools are mounted in a standard die set and consist of the embossing punch *B* inserted in the plate *C* and backed up by plate *D;* the blanking punch *E* mounted on the die shoe; the blanking die *F* attached to the punch holder; the stripper *G* guided by the shoulder screws *H* and operated by springs at *J;* the knockout *K* operated by plate *L;* the pins *M* attached to the shedder *N;* a plunger *P;* and the spring *Q*.

In operation, the scrap stock is placed on the blank-



This die was designed to emboss the part just after the ram begins its descent, and blank the part as the ram nears the end of its stroke

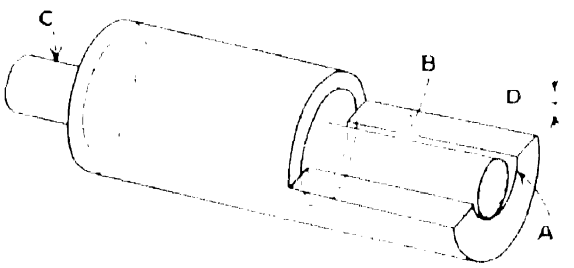
ing punch and as the ram descends the part is embossed. As the ram continues its descent and nears the bottom of its stroke, the part is blanked by the punch as the blanking die passes over it. On the upward stroke of the ram the stripper is forced upward by the springs and strips the waste stock from the blanking punch. The knockout is operated by the knockout bar on the press through pins on the shedder and pushes the part out of the blanking die.

Measuring the Radius of a Cut-Away Bore

By WILLIAM S ROWELL

Two methods for measuring cut-away bores, such as shown at *A* in the drawing, were suggested by Mr. George Belbes (*AM*—Vol. 84, page 472). In both methods, it is suggested that the spindle be turned until the faces *B* of the cutaway bore are brought into horizontal alignment by means of a vernier or indicator. The writer believes that there is a simpler way of doing the job.

In the first method suggested, a rod *C* is inserted in the bore, and an indicator or vernier reading taken at the top of the rod. The difference in height *D* between the faces of the half bore in the top of the



The radii of half bores can be measured in a variety of ways· the author suggests that a straight edge and height gage can be used as conveniently as the methods described in the text

rod, subtracted from the diameter of the rod will give the radius of the cut-away bore.

In the second method, after the faces *B* are brought into horizontal alignment, Mr. Belbes suggests finding the lowest point of the bore with the aid of an indicator, and subtract the reading from that of the faces *B*.

Both methods suggested by Mr. Belbes, assumes that the surfaces *B* are in the plane of the centerline of the bore. Mr. Belbes' suggestions were offered as improvements on a method described by H. Moore, (*AM*—Vol. 83, page 919) However, Mr. Moore stated that the part cut away was on or *below* the centerline. Mr. Moore's method is convenient and requires little time; but because of expensive apparatus, it can only be justified by making a considerable number of such bores.

One need not follow Mr. Belbes' suggestions in determining the radius of half bores. If the surfaces *B* are in the plane of the centerline of the bore, the radius of the cut-away section can be found in a number of ways. One would be to place a straight edge on the surfaces *B* and measure the greatest rise, or drop, of the bore from it, thus securing the radius. If the plane of surface *B* does not coincide with that of the bore centerline, the amount and direction of

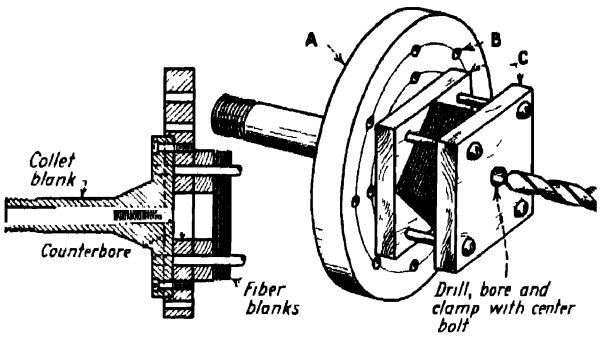
the variation can be obtained by using a height gage. Then the variation can be added to, or subtracted from, the measurement from the straight edge, thus giving the radius.

Accurate Washers from Thin Material

By LAURENCE F SOUTHWICK

There is nothing new about the boring plate. But how many people know that it can be used successfully to bore and turn washers from thin material? We recently used it for making fiber washers.

We made a light faceplate of cast iron 5 in. in



This boring plate was designed to bore and turn accurately washers made of thin material The faceplate is used as a templet for laying holes in the holding blocks

diameter and ½ in thick To this was bolted a collet blank as shown in the drawing Eight radial lines were scribed on the faceplate, 45 deg apart Three circles, ½ in. apart were also scribed on the faceplate Holes were drilled at the intersection of the circles and radial lines, every other hole being tapped. This allows the faceplate to be used as a templet if desired. The center of the faceplate is counterbored to permit drilling washers assembled as shown in the drawing

The washers we made on this boring plate were of 0·015 in. fiberboard, 0 650 in. inside diameter and 1 370 in outside diameter. The material was cut into squares slightly larger on the side than the finished diameter. Two square hardwood blocks *D* were cut large enough to give adequate stock for drilling through the corners to correspond with the holes in the faceplate. The holes in the block were scribed using the faceplate as a templet.

The two blocks and fiber squares are assembled as shown in the drawing, the four screws through the corner holes of the block clamping the assembly to the faceplate. The block and fiber squares are drilled and bored. After boring, the assembly is clamped by a bolt and washer. The outer screws are then removed. Excess material can be removed from the corners with a hacksaw prior to turning the outside diameter.

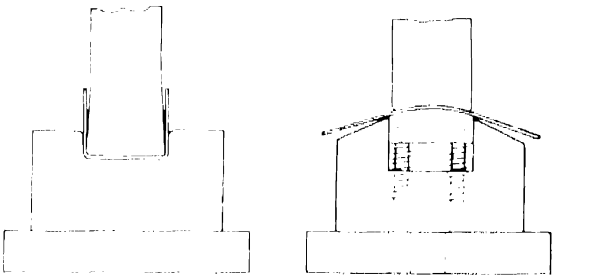
This plate can be used advantageously for boring a hole exactly concentric with an established outside diameter, or to any amount of eccentricity desired by reversing the above procedure. First clamp through the center and indicate the outside, dead true or eccentric, as desired. Then, using a metal ring instead of the wood pieces, replace the center clamp with outside screws and bore.

Compensating for Spring Back in Press Tools

By L KASPER

In the press forming of flat stock into channel or similar shapes, the common design of forming die consists merely of a grooved block with a punch to force the material down into the groove. This, of course, is the simplest form of die construction, and in many cases proves entirely satisfactory, especially if the material is dead soft. However, if there is a tendency for the material to spring back after forming, the sides of the channel will not be formed parallel. In such cases, it is customary to relieve the punch in back of the forming corners in the hope, which is not always fulfilled, that the material will throw away from the forming corners of the die. One objection to this method is that sometimes it is necessary to fit the punch and die closely, so as to "iron out" the material, which usually leaves draw marks on the work.

At the right in the drawing is a die in which provision is made for the spring back of the material after



Although the punch at the left relieves spring back, it may leave draw marks on the work. With the die at the right the corners are formed while the bottom is held in a sprung condition, thus compensating for outward spring at the corners

forming. The work face of the punch is concave, and the face of the pressure pad is convex, the arc of these surfaces being determined by experiment and must not be sufficient to produce a permanent set to the material. The springs must be sufficiently strong to cause the material to conform to the curved surfaces before any forming is done on the corners. As the formed piece is removed from the die, the tendency is for the two sides to spring outward from the corners, but as the corners have been formed while the bottom is held in a sprung condition, the tendency is for the bottom to straighten out and throw the sides inward, thus compensating for the outward spring at the corners.

SHEET SHAPE
FOR AIRCRAFT

BY LOUIS H. BIEHL
Superintendent of Tooling
Lockheed Aircraft Corporation



Specially built Lockheed profiling machines permit two operators to work at once. Canvas curtains, here pulled back for the photographer, keep chips within bounds

SHEET SHAPES FOR AIRCRAFT

By LOUIS H. BIEHLER

Superintendent of Tooling Lockheed Aircraft Corporation

A special system of drilling and routing permits multiple profiling of many sheet aluminum aircraft parts. With this method small lots can be turned out efficiently

INCREASED USE of flat sheet stock in aircraft manufacture has made necessary improved means for manufacturing irregularly shaped blanks from rectangular stock. This problem is particularly difficult due to the complex shapes and variety of sizes required by aircraft design. Lockheed Aircraft Corporation, in common with other manufacturers of metal aircraft, has developed equipment specifically designed to meet the requirements of minimum tooling outlay, maximum flexibility, and low cost, rapid, accurate parts production. Its combination drilling and profiling equipment permits production of finished blanks, including multiple drilling operations, with only one handling of material. This not only reduces handling time but minimizes marring of the sheets themselves, an important consideration in aircraft.

The basic profiling principle is to stack a number of standard sheets on a table and to cut them all at once to the outline of a single pattern, using a router bit as the cutting tool. The process is sufficiently flexible to permit profiling a single sheet or a stack of fifteen. It is possible to arrange small patterns on a large layout so that only about nine per cent of the original stock is wasted.

The drilling and routing unit consists of a heavy central pedestal on which are pivoted two jointed arms to support router or drill heads. These machines were designed to specifications and built in the Lockheed shops with the cooperation of various tool and equipment manufacturers. Their construction is quite rigid, to permit steady movement of the router and to eliminate chatter. The joint on the swinging arm permits the tool to reach any point within a circle sixteen feet in diameter, except within twelve inches of the inner pivot point. Complete freedom of motion of the inner pivot is attained through large roller bearings, well protected from dirt and chips. The arm is equipped with cone adjustments on bearings at the pivot point and at the knee, to take up wear.



First operation in multiple-sheet profiling is drilling locating holes through a stack of blanks. Sheet metal templet is held with quick-acting clamps. Sheets will later be bolted directly to plywood routing table top

Operation of the machines is always in pairs; that is, both arms on one pedestal are used for routing, and both arms on another pedestal are used for drilling. This prevents chips from a routing tool from interfering with operation of a drill, whereas the router operators, being accustomed to a heavy volume of chips, are not disturbed by them. The stream of chips discharged by the routers is localized by canvas curtains around each pair of routers.

Special portable tables, 48x144 in., support the stacks of material for drilling and profiling. These table tops are the same size as standard aluminum alloy sheets. Tables may be moved about at will on suitable casters and locked in position by quick-acting jacks. Each table top is built up of heavy plywood to provide for attaching the stock by lag screws.

Special Heads Necessary

Drills are driven by an electric motor of about ¾ h.p. operating at 1,720 r.p.m., mounted at the end of the pivoted arm. A manually operated drill spindle carries a hardened steel bushing to locate the drill accurately and to maintain pressure against the stack of material. This improves accuracy and prevents drill chips from creeping in between the sheets.

The router head is driven at 15,000 r.p.m. by a high-frequency electric motor. This motor is mounted on vertical ways at the end of the pivoted arm, and may be raised and lowered manually for feeding the cutter into and clearing it from the work. This provides a degree of control over the tool head which permits extreme flexibility for internal and external profiling of complex shapes. Although most of the material handled is Dural or clad alloy, it is possible to rout such sheet materials as linoleum, copper, brass, Plexiglas, Micarta, Masonite, etc.

Actual cutting in profiling is accomplished by router bits. These bits are special single-lipped spiral-fluted end mills. Due to the speed at which they operate, they are provided with much greater rake and clearance than standard mills. They also have a slightly concave face. Best operation, from the standpoint of parts design and routing, is obtained with a bit about 5/16 in. in diameter. Although this size limits internal

cutout radii to 5/32 in., this does not interfere with design to any extent. A cutter of this size has sufficient strength and rigidity to withstand hard usage and fast cutting.

The quantity of work possible with these cutters depends to a large extent on their sharpness. As soon as the edge has worn off, speed and cutting smoothness decrease, overloading the motor and frequently resulting in the tool hanging up and breaking. Practice indicates that a bit may be used for routing Dural for approximately two hours per grind. Cutter grinding consists only of removing sufficient stock to renew the cutting edge. Cutters may be reground repeatedly until the land has been completely removed, after which they must be discarded. Minor changes in cutter diameter are compensated for by graduated guide collars on the chuck shank.

Guide Blocks Also Routed

Routing is done with individual guide blocks, against which the guide collar bears during cutting. These router blocks are usually made of sheet Masonite or wood about ½ in. thick. Individual flat layout templets serve as patterns for making these blocks. Most are cut on a wood shop router directly from these templets. In making the router blocks suitable allowance is provided for the difference in diameter between the router bit and the guide collar. Router blocks which involve aggregate cutouts or narrow sections are sometimes provided with a reinforcing plate to prevent distortion due to pressure of the guide collar.

Pre-drilling of stacked sheets before routing is done with a master drill templet. These templets are the same size as the stock sheets which are to be drilled. Flat layout templets for individual parts are grouped on a sheet of ¼-in. plywood, nesting together with about ½ in. of space between them. Enough templets are used to cover effectively the entire sheet surface. After the arrangement has been completed, these individual templets are riveted in place on the plywood. Templates carry all the hole layout required by the part design and, in addition, at least two 3/16-in. locating holes for securing router blocks during subsequent operations.

A typical work cycle for production of drilled blanks is as follows: The desired number of stock sheets are stacked on the router-drill table and the master drill templet placed upon the stack. This assembly is clamped firmly in position on the table by quick-acting clamps, and the layout is then moved to the drilling station and locked in place. The drill operator goes over the entire surface of the templet, drilling all holes as called for by a suitable drill size code. When drilling is complete, the table is moved away from the drill station to make way for the next table. The clamps are released and the master drill templet removed. Individual router blocks are placed in the proper positions and fastened by 3/16-in. lag screws which pass through the locating holes and engage the wood surface of the router table. An electrically driven wrench is used to insert and remove these lag screws.

When all blocks are in place the table is moved to the routing station and locked in position. The routing operator cuts the blanks by passing the router around the periphery and the internal cutouts of each block, making sure that the guide collar maintains constant bearing against the block. When all cutting has been done, the table is unlocked and moved to the unloading station. Here the lag screws are removed, the blocks taken off, and the completed blanks burred and stacked in racks. Metal remaining on the table consists principally of narrow strips of scrap which can easily be collected and salvaged.

Blanks produced by this method are characterized by clean, smooth edges. Both drilling and routing can be done rapidly and accurately by an experienced operator, with

tolerances approaching those obtainable with dies. A further advantage is the practical absence of rough edges which sometimes cause fracture during subsequent forming operations. Although the routed edges are for the most part free from burrs, it is sometimes necessary to perform a burring operation on the top and bottom blanks in a stack, since the edge of each of these pieces is not adequately supported during cutting. For this work a machine has been developed which washes off all foreign matter and presses down the burrs between polished steel rolls. This unit also removes excess water and discharges the blanks ready for subsequent forming operations. Development of this machine has practically eliminated former slow hand burring.

A typical table layout may involve drilling and cutting as many as thirty or forty different blanks producing up to 600 separate pieces, and drilling as many as 3,500 holes. Such a set-up may be run through the drilling and routing cycle in a little over an hour. Enough tables are used to that loading, drilling, routing and unloading stations may be kept continuously working. It is thus possible to produce blanks for small lot production at a very low unit labor cost. In some respects the process also shows decided advantages over punch press methods.

There are many variations of this process which may be applied to aircraft work. Drilling and trimming large flat skin sheets, slotting tubing and milling irregular outlines and cutouts in extruded metal sections are typical of the work which can be done with this equipment. It has also been found advantageous to use an adaptation of the wood shop pin type router for trimming form parts, and for cutting small flat blanks which cannot be satisfactory secured to the router tables. For such uses it is necessary to provide special router blocks or jigs which secure the part in a nest to present the desired face or edge to the router bit.





ABOUT FIVE YEARS AGO Rock Island Arsenal installed X-ray apparatus as a part of its continued program for improving the quality of national defense material. Recent additions have improved flexibility and capacity.

The original installation, having a maximum capacity of 500,000 volts, is used for the investigation and inspection of castings and welded parts. Walls of the room in which this equipment is installed are of 24-in. concrete, with lead doors for maximum protection to the operator.

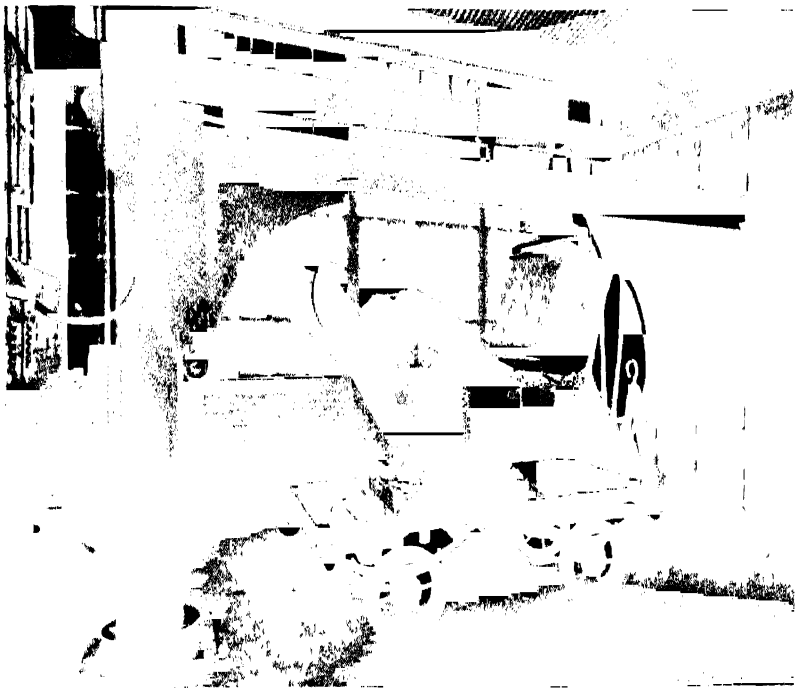
The new equipment consists of a complete X-ray laboratory adjacent to the welding shop. This equipment, having a 220,000 volt capacity, is used to inspect all stressed areas in gun carriages and other welded parts. Enough random views are taken to check uniformity of the welding. The installation provides maximum flexibility, and the arrangement of the complete X-ray department combines adequate space with compactness.

The tube itself is mounted in a shock-proof housing which has an 8-ft. travel on the arm of a jib crane. An electric lift with remote control makes it easy for the operator to change the vertical position of the tube. Since only secondary radiation is emitted from the tube housing, the outside two walls of the room—which have only an occasional passer-by—are not lined. The two working walls and doors are lined with $\frac{1}{8}$-in. lead sheets.

A standard rubber-tired shop trailer carries the parts into the X-ray room. The cart also makes a readily movable support for the parts under the tube. Trailers enter the room through a large sliding door which opens directly into the welding shop aisle. An electric motor and speed reducer drive a sprocket and chain which moves the door along an overhead track. Limit switches prevent overtravel. Safety switches are also used on the doors, so that the machine cannot be turned on unless the doors are closed.

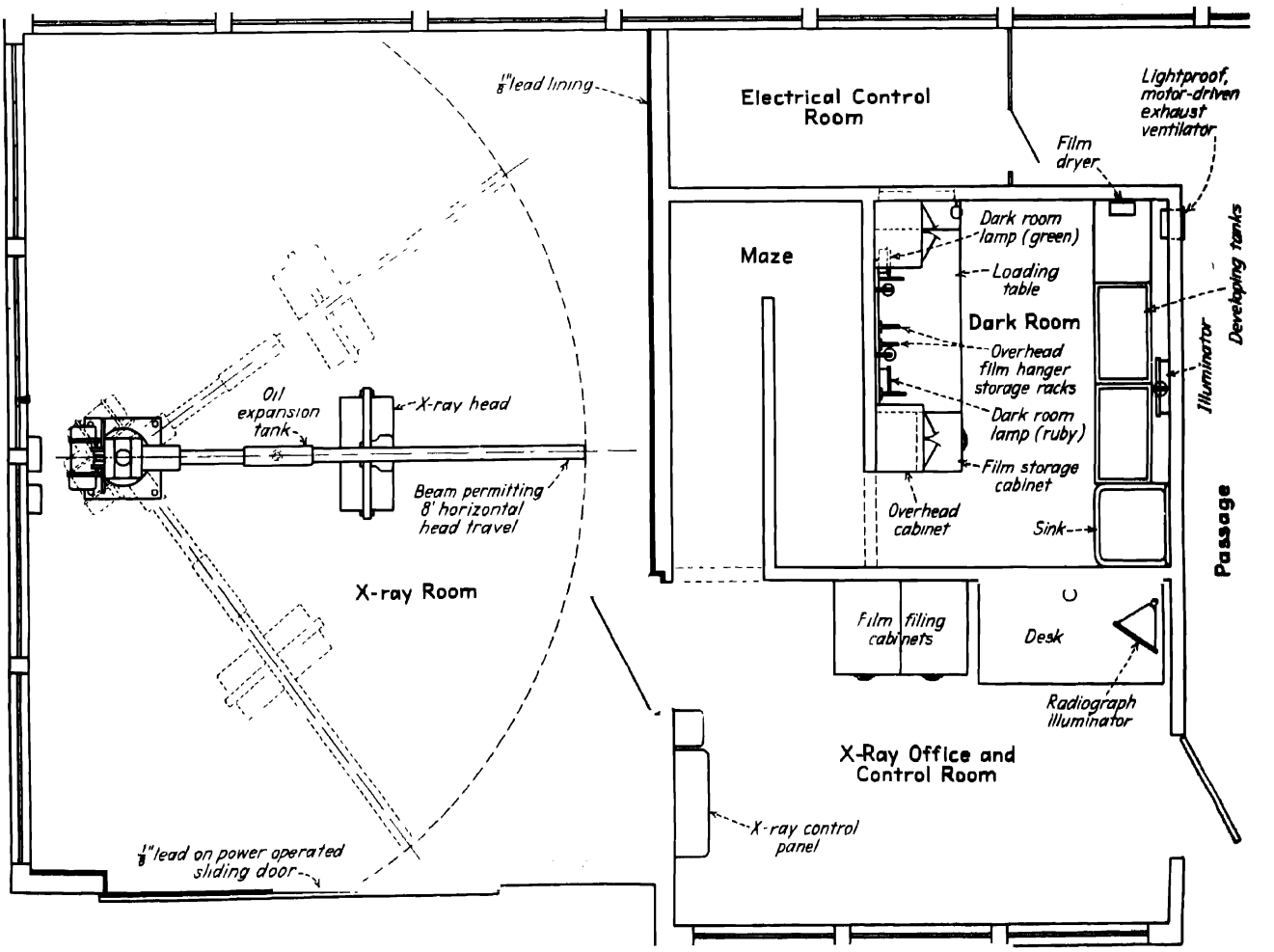
With the arrangement of the dark-room shown, it takes about 50 min. from exposure to finished negative. Watch temperature for film development is thermostatically controlled. Negative viewer has a rheostat so that intensity of viewing light can be controlled. Personnel required comprises one man in the X-ray room, one man in the dark room, and one-half time for a laboratory man to view the pictures.

A wide variety of cast and welded parts can be inspected in this 500,000-volt X-ray machine installed at Rock Island Arsenal



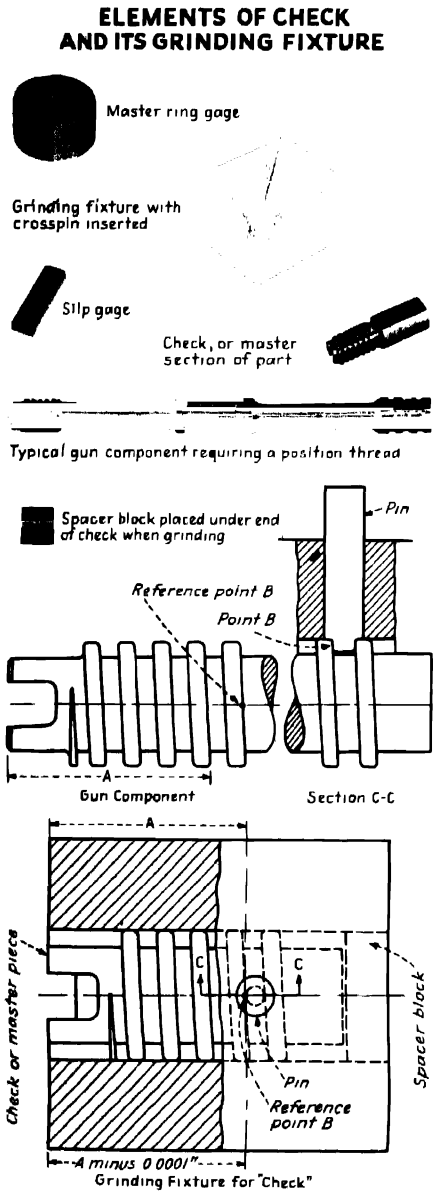
This 200,000-volt X-ray installation permits maximum flexibility for inspecting welds of many awkward-shaped castings. It is installed immediately adjacent to the welding shop. Lead sheets ½ in. thick prevent injury to plant personnel

Minimum space and maximum convenience are achieved in this compact layout of a complete X-ray inspection laboratory. Finished negatives can be viewed in less than an hour after exposure



Position-Thread Gage

Canada's method of making an accurate "check" for position-thread gages may prove helpful in American defense programs



Dimension A, *on the gun component, must be within 0.002 in. of the specified dimension. Point* B *must be held close to centerline of cross slot*

MANY DIFFICULT PROBLEMS fall to the lot of a toolroom engaged in making inspection and machine fixtures for machine-gun parts manufacture. One of the "skullcrackers" solved by the toolroom in the Canadian-Bren plant is the method of making the *check,* or master piece, used for setting up both types of fixtures employed on work involving "position threads." A position thread may be defined as one in which a definite dimension must be maintained between a point on the thread helix angle and either an end face or some other location on the piece.

For the gun component sketched, dimension *A* between the end face and reference point *B* on the thread helix angle may have a tolerance of plus nothing, minus 0.002 in. Moreover, point *B* must lie on the centerline of the cross slot within a minute or two of arc.

The major difficulty centered about making a fixture for grinding the end face of the check, at a definite dimension from point *B* and with due regard to the angular position of the cross lot. The following solution was worked out after much study:

A rectangular steel block is ground with all six sides square within a tenth, and a through hole bored square with the sides within a tenth. A slot is milled in one end of the block and a cross-pin hole is drilled at approximately distance *A* from the end face. Two steps are ground on the end of the block, one equal to distance *A* from the crosspin hole and the other a tenth of an inch less.

To grind the check, the part is inserted into the larger hole, with the slotted end clearing the stepped end of the block. A slip gage is inserted in the slots in the end of the block and work, after which an accurate cross pin is inserted in the cross hole so that a tit firmly bears against the thread flank at point *B*. It is now a simple matter to grind the tongues of the check flush with the respective steps on the block.

The check is used in setting up machine fixtures as follows. Prior to milling the slot on the gun component, the check is screwed into a ring-gage element in the fixture. Then a spotting face is positioned against the end of the check. Thus, when work is screwed into the fixture and against the spotting face, it protrudes the correct distance for milling the slot. The same general idea is used when setting up to grind the end face.

Inspection fixtures have adjustable locating surfaces that are positioned daily in relation to the master check. For example, the check is laid in the fixture and a master ring gage of correct thickness is screwed onto the check, so that the slots can be aligned with a slip gage and the surfaces of check and ring gage are flush. Next, locating surfaces in the fixture are positioned against the master ring gage. Upon removal of the check and master ring gage, work pieces can be laid in the fixture and a ring gage run onto the threaded end and against the locating surfaces, to establish that dimension *A* is being maintained in production, and also that other dimensions bearing a relation to dimension *A* are coming within established tolerances.

Without an accurately made *check* it would be impossible to establish accurate setups on position-threaded work, either for machine or inspection fixtures. But before an accurate *check* could be made, a method of producing its grinding fixture had to be developed.

Pressures and Blanks for Press Work

Courtesy of The Cincinnati Shaper Company

TONNAGES PER LINEAL FOOT FOR BENDING MILD STEEL WITH AIR-BEND DIES *

Thickness of Metal		Width of Female-die Opening, In																						
Gage	Inches	1/4	5/16	3/8	7/16	1/2	5/8	3/4	7/8	1	1 1/8	1 1/4	1 1/2	2	2 1/2	3	3 1/2	4	5	6	7	8	10	12
20	0.0375	3.12	2.25	1.68	1.43	1.10																		
18	0.0500	5.31	4.00	3.00	2.47	2.22	1.74	1.28																
16	0.0620	9.59	7.08	5.55	4.50	3.75	2.78	2.18	1.77	1.47														
14	0.0780		11.90	9.23	7.58	6.25	4.68	3.47	2.98	2.45	2 11	1.84												
12	0.1090				16.70	13.10	9.69	8.02	6.54	5.56	4 58	4.06	3 20											
11	0.1250					19.20	14.20	11.10	8.99	7.50	6 34	5.54	4 35	2 94										
10	0.1410						18.60	14.50	11.90	9.94	8 46	7.29	5 77	3.95										
3/16	0.1875							27.40	23.10	19.30	16.40	14.30	11.20	7.50	5.70	4.40								
1/4	0.2500									39.40	33.30	29 50	22.70	15 40	11.40	9.00	7.35	6.06						
5/16	0.3125											50.40	39.80	27.00	19.70	15.30	12.70	10 50	7.74					
3/8	0.3750												61 60	42 30	30.90	24.00	19.60	16.30	12.30	9.46				
7/16	0.4375													61 70	45.80	35 40	28.60	24.40	17.30	14.80	11.20			
1/2	0.5000													85 20	63.60	48.80	39.70	33.30	24.60	19.40	15.90	13.10		
5/8	0.6250														110.00	86.20	70.00	58.30	43.10	33.30	27.40	23.30	16.90	
3/4	0.7500															138.00	110.00	93.00	68.70	53.50	43.60	36.50	27.10	21.00
7/8	0.8750																165.00	137.00	104.00	80.70	64.60	52.90	39.70	31.60
1	1.0000																	197.90	143.00	113.00	91.20	76.20	56.30	44.20

* The tonnages underlined are for V-die openings eight times the thickness of the metal. These generally are used for average right-angle bending work.

PRESS BRAKE tonnages required per lineal foot of stock to make simple single bends in mild steel are given in the table. Mild steel, having a tensile strength of 55,000 to 65,000 lb. per sq. in., is used as the standard, since the bending pressure varies directly as the tensile strength of the material. For example, for any material having a tensile strength of 90,000 lb. per sq. in., the tonnages in the table should be increased 50 per cent.

The tonnages given are based on using "air bend" dies, which contact the metal only at the point of the male die and the two points of the V-die. All the pressure exerted is put into forming the metal; none for squeezing it. The dies are said to be standard when the opening is eight times the thickness of the metal to be bent. The tonnages underlined in the table are those for standard V-dies; thus, 7.5 tons per foot of length is required for bending $\frac{1}{8}$-in. mild-steel stock in a V-die with a 1-in. opening. For bending the same stock in a V-die with an opening five times the thickness of the stock, that is $\frac{5}{8}$ in., 14.2 tons per lineal foot would be required.

Approximately, the pressure required varies inversely as the V-die opening. Enlarging the opening to twice the standard, reduces the pressure more than one-half. Reducing the opening to one-half standard, more than doubles the pressure.

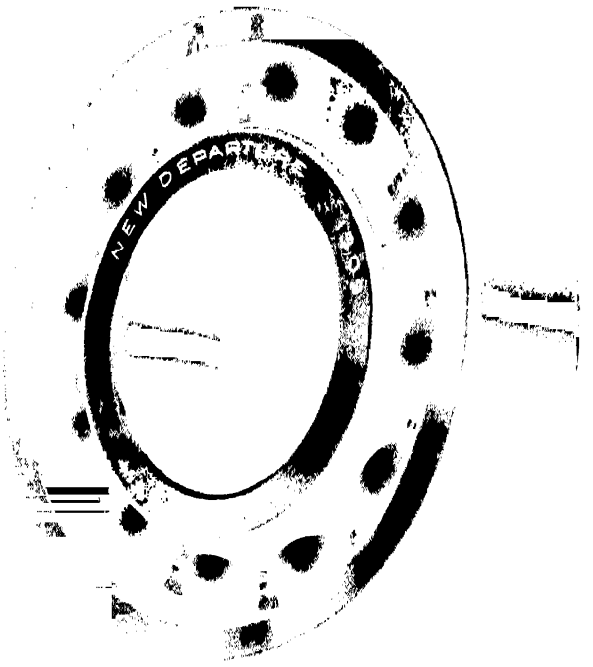
The pressure required varies directly as the metal thickness. Twice the thickness increases the pressure more than four times, while one-half the thickness decreases the pressure to less than one quarter.

The pressure varies directly as the length of the stock. Twice the length requires twice the pressure, and one-half the length requires one-half the pressure.

The inside radius of a bend is approximately 5/32 of the V-die opening regardless of the gage of the metal being formed. If a $\frac{1}{8}$-in. plate and a $\frac{1}{4}$-in. plate were formed over a 2-in. die, each would have the same inside radius—approximately 5/16 in.

When bending ordinary mild-steel plates more than $\frac{1}{2}$ in. thick, it is as a rule necessary to use a die opening greater than eight times the thickness of the plate to prevent

RESOURCES *for* RESEARCH



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Pressures and Blanks for Press Work

fracture. High-tensile steel plates, even in the thinner gages, must be formed over die openings ten to twelve times their thickness.

Special flanging or boiler steel is often used to eliminate breakage when necessary to bend heavy plate over small die openings.

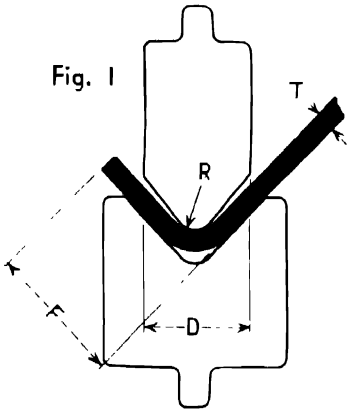
When making a 90-deg. bend, the pressure rises very rapidly. It reaches 85 per cent of maximum when the metal is bent only 20 deg., and the maximum when bent 40 deg. The pressure drops only a few per cent when metal is bent 90 deg.

If the dies are struck solidly together, there is no limit to the pressure that can be applied.

Length of Blanks

Following are data on the use of V dies and the calculation of the developed width of sections so formed. The standard V-die opening in press brake work is eight times the thickness of the metal; that is, referring to Fig. 1,

Fig. 1



$$D = 8T$$

When this is done, the inside radius R on the work will be governed by the die width as follows:

$$R = 5/32\ D$$

If the radius on the male die is greater than $5/32D$, then the work will follow the male die but will distort if the radius becomes very large. In Fig. 1, the minimum flange F possible to form can be determined by the formula

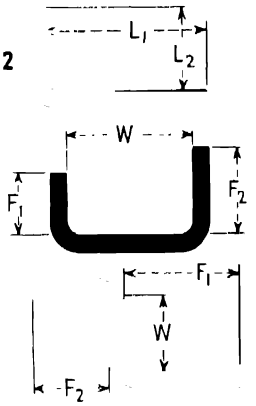
$$F = (D/2) + 2T$$

The pressure in tons per foot of length for forming mild steel on V-dies are given on page 933.

Blank Calculations

If the inside radius on the work approximately equals the gage of the metal, that is $R = T$, then for

Fig. 2



shapes shown in Fig. 2 the developed width can be found as follows:

For angles

$$\text{blank width} = L_1 + L_2$$

For channels

$$\text{blank width} = W + F_1 + F_2$$

For Z-bends

$$\text{blank width} = W + F_1 + F_2$$

Note that all dimensions are to the inside. The great majority of V-die work will fall in the foregoing classes. To layout bend lines, the bends are marked on the inside of the work using inside dimensions of work as shown in Fig. 2.

If the radii differs much from $R = T$, some correction must be made. A general method of calculating blank sizes on straight sections where the radii are not the usual size, as assumed above, is as follows:

$$\text{Blank width} = (W + F_1 + F_2) - [3T + (R/2)]$$

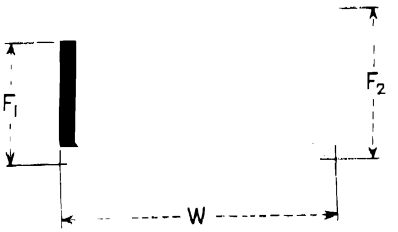
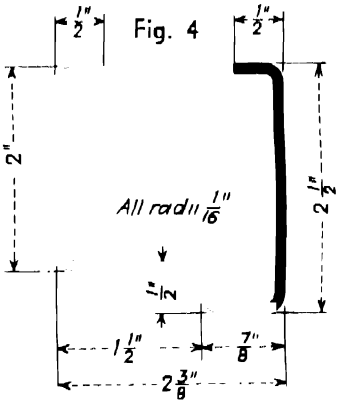


Fig. 3

where the dimensions are to the outside as shown in Fig. 3. To use this formula on multiple bends, add all outside dimensions around the piece and deduct $[3T + (R/2)]$ for each two bends involved. For example, take the shape shown in Fig. 4, bent from 1/16-in. stock. Adding the outside dimensions around the section, beginning at the upper left-hand corner

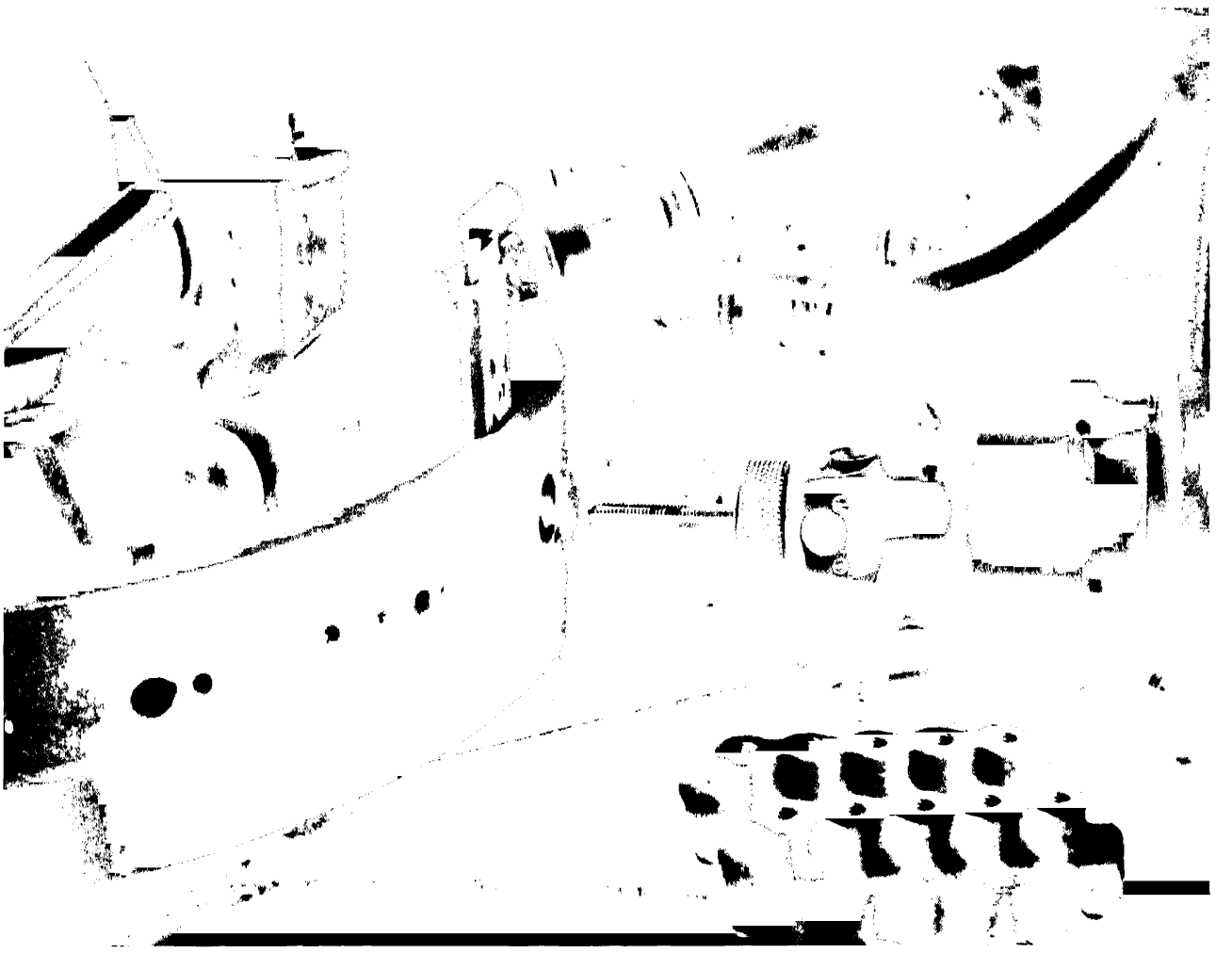
First straight section	0.500 in.
Second straight section	2.000 in.
Third straight section	1.563 in.
Fourth straight section	0.563 in.
Fifth straight section	0.875 in.
Sixth straight section	2.500 in.
Seventh straight section	0.500 in.
Total	8.501 in.
Deduct six bends, $3[3T + (R/2)]$	0.656 in.
Blank width	7.845 in.

Fig. 4



Allowances for bends made across the grain in mild steel, using V-dies, are as follows:

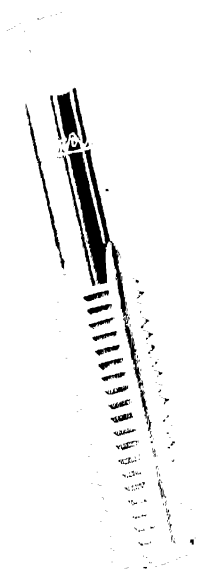
Gage, T	Radius, in., R	Allowance, in.
24	1/32	0.062
22	1/32	0.065
20	1/32	0.070
18	1/16	0.120
16	1/16	0.131
14	1/16	0.139
13	3/32	0.196
12	1/8	0.254
11	1/8	0.262
10	5/32	0.295
5/32	5/32	0.327
3/16	3/16	0.393
7/32	7/32	0.508
1/4	1/4	0.524



"GTD Greenfield" Taps Chosen for this hard job

Here's a ten-way double junction casting turned out by a big specialty manufacturer—10 tapped holes in each cast-iron piece. To handle it economically calls for a real investment in tapping machinery and fixtures *plus good taps*. The company saves itself money by using "GTD *Greenfield*" 5 16-24 Ground Thread High Speed Steel Bottoming Taps—to the tune of 240 completed tapped holes per hour.

Don't make the mistake of figuring tap "savings" on the cost of the taps. Figure on cost per tapped hole. "*Greenfield*" can help you get your costs down on this basis—and will be glad to work out test runs on your own work to prove it.



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TAPS DIES GAGES TWIST DRILLS REAMERS SCREW PLATES PIPE TOOLS

Let's Look at the Record

FOR THE first time John Public is reading about machine tools. Also for the first time his son or daughter is being asked by school teachers to write about "machine tools and defense." When an industry rates special attention in the schools something must be happening. When newspapers give it space along with air raids, politics, murders and comic strips, it must be NEWS in capital letters.

The machine tool industry *has* made news the past year! And it is the kind that renews one's faith that the system of private enterprise hasn't lost its virility, its resourcefulness and its ability to meet a crisis, despite the buffeting taken during the depression.

Let's look at the record.

The machine tool industry numbers less than 250 companies with a total investment not exceeding the cost of two battleships—$150,000,000. Its volume of business on the average is only $100,000,000 a year, which is less than Ford parts sales (not to mention Ford cars).

It has no Pittsburgh, no Akron, no Detroit. Its relatively small plants are scattered over a considerable part of the country east of the Mississippi and north of the Ohio. It employs in a moderately good year some 50,000 men, or fewer than walk through the gates of Chrysler Corporation any normal working day.

In the worst depression year the industry's orders fell to a mere $22,000,000. Average earnings the last decade were not even respectable. This in the least predictable of industries, whose ups and downs would quickly drive a Dr. Gallup to raking leaves if he tried to forecast the trends.

Then came the clarion call in September, 1939, when the war broke. The call grew louder as our defense program took shape. For nothing is more vital to defense industries than machine tools.

Here is how the industry responded: it increased its manpower by thousands and went to multiple shifts. New talent was trained, and still is being trained, by the hundreds. Millions were invested in new machine tools to speed work.

New plants and additions were erected, though managements realized that only the emergency warranted more capacity and that the increase of over 30 per cent would be "excess baggage" when business returned to normal. Work was farmed out in large quantities. The subcontracting system for parts and subassemblies spurred production greatly.

Following the pattern of 1917-18, new companies have been attracted to the machine tool manufacturing field because of the unprecedented volume of orders, and they will make their production felt in the coming months.

The results? This small industry has been enlarged, entirely without government funds, to a point where in 1941 it will turn out in excess of $500,000,000 of machine tools. It is still in the process of providing more capacity. Today no country has a machine tool industry which challenges it in size or quality of product.

It is this industry which has won Mr. Knudsen's highest praise for its defense performance. It is this industry which is putting into the hands of companies with defense contracts the most productive and the highest quality tools the world has ever seen. It is this industry which has voluntarily put into force a preference rating system designed to supply defense agencies with what they want ahead of all other customers.

If other industries will discharge their defense obligations as rapidly and efficiently as machine tool builders, we need entertain no fears that the armament program will be carried through without unnecessary delay.

Burnham Finney

GAGING BUSINESS

Election results likely to speed up metal-working operations as pressure is applied for quicker rearming and for more aid to Britain. Monthly machine tool output totals $40,000,000.

Metal-working operations will be further stimulated as a result of the national election. The Administration is expected to bring increased pressure to speed up defense preparations and to give more aid to Britain. From now on through the Winter the biggest problem facing metal-working plants will be squeezing out just as much production as possible. Output should be sustained at an all-time high level.

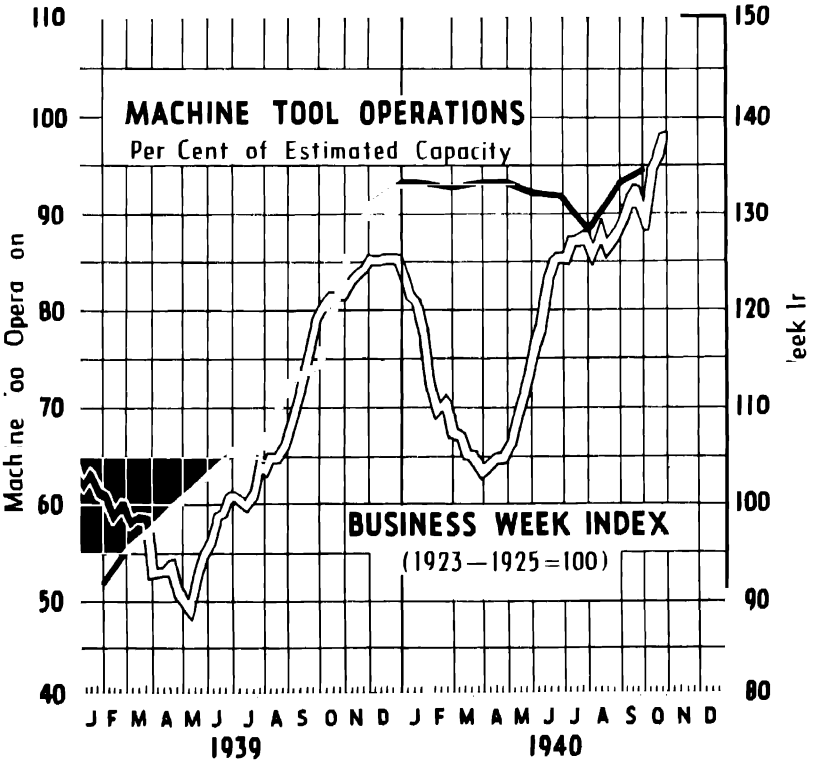
Machine Tools—October was the biggest month in history for many machine tool builders. Hardly any diminution in the volume of orders is looked for during the next few weeks, if inquiries can be taken as a criterion. Most of the unprecedented bookings by the industry stem directly from aircraft, munitions and shipyard needs in connection with the defense program. The first to place machine tool orders for defense work were companies along the Atlantic seaboard, where contract awards were heavily concentrated. Lately, however, defense business has spread into the middle west, and machine tool sales have been on a huge scale in the Pittsburgh, Detroit, Chicago and St. Louis areas as well as along the east coast. Whereas not so long ago export orders accounted for 30 to 50 per cent of the industry's total, now they have fallen to 15 per cent. Few machine tools except those destined for England or British dominions are going out of the country. Deliveries to England are being speeded this month, but opinion is growing that machine tools should be kept in the United States where munitions can be made for Britain without danger of bombings. Reliable reports from England, on the other hand, say that a surprisingly small number of machine tools have been put out of commission or destroyed by German bombers. The industry is now producing close to $40,000,000 of machine tools a month, though an average year's business is not much over $100,000,000. Plant capacity has been expanded more than 35 per cent since the war started. Shortage of trained men has prevented some companies from going to three shifts.

Railroad Equipment—Except for track materials for 1941 delivery, buying has tapered. With car loadings expected to be good next year, carriers are planning for reasonably heavy purchases of cars and locomotives.

Aircraft—Plane and engine orders have passed the $3,000,000,000 mark, a figure little dreamed of a year ago. Bookings are still steadily mounting. Ford, for example, has just been officially awarded a $125,000,000 contract for Pratt & Whitney motors, production of which will begin next spring. At a time when aircraft people are rushing new plants to completion, the automotive industry is being drawn in as the spearhead in a program to provide Britain with an additional 12,000 planes over and above previous commitments. This program, calling for building of parts and subassemblies by motor car companies, will require erection of many new plane assembly plants, perhaps as many as 15, probably in the Detroit district. The training of some 300,000 men, needed by companies in or doing work for aircraft manufacture, presents one of the serious problems.

Steel—Steel mills are operating at an all-time high. Both U. S. Steel and Bethlehem have been running above 100 per cent of theoretical capacity. Executives are confident that defense needs can be met without increasing basic steel capacity. Aside from possibility of a tight squeeze for a short time next spring, the industry believes it can take care of estimated defense tonnage and at the same time supply all the non-armament industries and the export trade. Some 40 per cent is being added to electric furnace capacity. This is in anticipation of large alloy steel orders.

Munitions—Army and Navy contracts have been placed in tremendous volume lately, particularly for artillery ammunition components. Lansdowne, Steel & Iron Co., Morton, Pa., has a War Department order for ammunition components totaling $17,283,750, Willys-Overland for $8,820,040, Budd Wheel Co. for $7,818,380, Tennessee Coal, Iron & Railroad Co. for $5,823,600, and Le Tourneau Co., Toccoa, Ga., for $4,569,290. Because of the unavoidable tooling-up process, manufacture of munitions will not be under way on a large scale until some time in the first half of 1941. Subcontracting of munitions business is aiding many industries. Five makers of printing equipment, for example, have munitions orders.



Aircraft Production To Be Aided by Auto Industry As Present Plane Output Lags

BY ROBERT COLBORN

WASHINGTON — The airplane program is going to be stepped up—perhaps almost doubled. The auto industry is being called in to do the job. The dimensions, even the objectives and methods, of the new program are still hazy. What is established is that the administration, and Knudsen, are dissatisfied with the present output of aircraft. The industry is falling behind the schedule set up, and Knudsen at least is not convinced that they will catch up to it. On the basis of his tours of the plane factories, he feels that the airplane people don't know enough about quantity production, and he is turning to Detroit for that knowledge.

The whole thing, of course, is contingent on Congressional action, but this will doubtless be forthcoming. Probably late this month Congress will be asked to appropriate some three billion or more for plants and aircraft.

It is fairly definite that the new program will include 12,000 bombers. Of these 8,000 will be two-engine ships of a model probably based on the Martin B-27, while 4,000 will be four-engine "Flying Fortresses," perhaps following the design of the Consolidated B-24. In addition there will likely be some 8,000 airplanes of a pursuit type. These 20,000 planes would nearly double the 25,000-odd combat ships included in the present 35,000-plane program. There is some talk of including a contingent of trainers, perhaps some 10,000, in the new program. Of the new ships, 12,000 are scheduled to go to the British—5 or 6,000 bombers and the remainder pursuit.

Will Make Aircraft Parts

To the auto industry has been assigned the production of parts for these planes and of sub-assemblies running up to tail and wing sections. The idea is that general purpose machine tools can be made available by more intensive utilization of machinery now on auto production. For instance a stamping press may be free for other uses by working three shifts on another press. It is not thought that production of dies would offer any great problem, since the Detroit tool and die shops, with some 10,000 workmen, are at low activity.

Final assembly cannot be done in the auto factories, and new assembly plants are going to have to be built —perhaps as many as 15 or 16—with British and U. S. funds. The plant expansions already planned cannot handle this added job, except in the unlikely event of complete re-scheduling of the existing program, and the new plants will probably be in the Detroit area. Finding management for these plants is going to be difficult. It will have to be drawn from the aircraft industry, and that industry's executive and supervisory forces are already spread out so thin as to have an adverse effect on production.

It may be that the new plan will be treated as an emergency program aimed exclusively at immediate production. In this case, the production methods of the airplane industry would probably be duplicated, and little effort made at real mass production.

On the other hand, it may be decided to rely on the program now under way for immediate output and aim the new plans at the future, at building up a big capacity perhaps a year from now. This would imply some procurement of special purpose tools, restudy of production methods, probably some re-design to facilitate mass production.

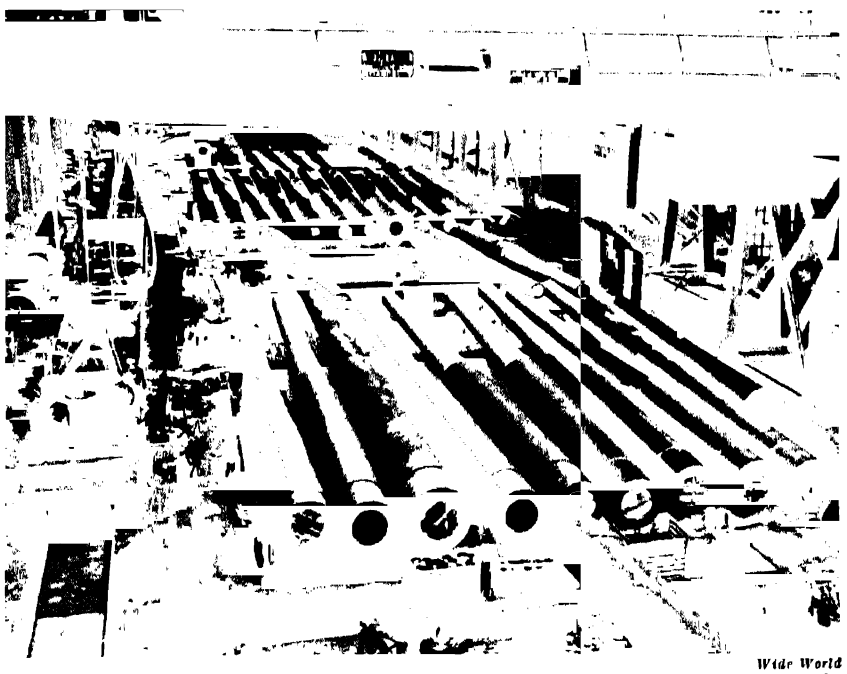
If the latter course is adopted, the final result might be some such set up as that in Germany, where one branch of the industry develops and tests new models, while another grinds out standardized types. It might also segregate the excess capacity of military needs over civil into a few government-owned plants which could be held in stand-by condition when the war's over.

NAVY WAGE INCREASE

WASHINGTON — In its first general wage adjustment since 1929 the Navy will raise the pay of 44 classes of skilled and semi-skilled workmen and mechanical supervisory personnel outside of civil service. The purpose is to line up Navy wages with those paid by industry in the same locality. Some observers think that private business must now raise its wages to hold its men.

Unused Production Facilities May Be Employed by Sub-contracting

WASHINGTON—As defense production expands into more and more sectors of the country's economy, subcontracting becomes the major means of drawing into the program facilities now unused and of diverting to defense of production for civil use. It is by this means that the resources of the small firms are made available. The Defense Commission is now shifting its attention to this phase. Donald Nelson has had added to his multitudinous jobs that of Director of Small Business Activities. Acting through special officers in Federal Reserve banks, he will give small business men advice on the work needed, financing methods and the like. Because it is desired to draw on now unused capacity before disrupting civil production, a survey of machinery and men available in areas where major industries have shut down has been initiated.



Wide World

Guns For The Navy—*Finished guns of large caliber await shipment in the Washington Navy Yard above. This is just one of the eleven Navy arsenals throughout the U. S. producing guns for the proposed two-ocean fleet. The photo was taken by the National Defense Advisory Commission*

Cargo Ship Assembly Yard May Be Built Here By Britain; See Demand for Unskilled Labor

WASHINGTON — Great Britain is about to set up a 28-way cargo ship assembly yard on this side of the Atlantic, probably in the United States, to turn out "pointed boxes" at a fast rate. The roughly-designed bottoms would use mostly common labor, so as not to cut in much on U. S. skills, and would represent a minimum loss if sunk. Parts would be built in various sections of this country and Canada by plants not loaded with other defense jobs and shipped to the yard for assembly.

The British, not yet short of cargo space but seeing difficulties a couple of years ahead at their present rate of loss, sent four commissioners to see Treasury Secretary Morgenthau. Evidently Britain's plan had the Administration's blessing. Morgenthau sent the commissioners to Admiral Emory S. Land, chairman of the Maritime Commission, for advice, which the Admiral is well qualified to give, since his experience covers both Naval and merchant ship building.

Baltimore, New Orleans, Portland, Oregon, and Los Angeles have been named by informed commentators as the possible locations of the British plants. The project would be privately financed. J. P. Morgan and the Dawes Brothers' Chicago banking firm are reported as interested.

Skilled Labor Is Greatest Problem

Washington authorities, questioned by AMERICAN MACHINIST, explained how problems incident to the British project will be met. Skilled labor supply is most crucial, of course. The British ships will have hardly any of the refinements of our own C-1, C-2, and C-3 designs; they will be little more than powered scows. Evidently, the British themselves dubbed them "pointed boxes." They will be substantial enough: riveted steel hulls with an engine, a deck, and a lot of freight space.

After skilled labor, the next most serious problem will be machine tools for those plants that will turn out the power and propelling machinery for the ships. One partial answer will be to call upon firms that make boilers, shafting, etc., for other marine purposes. Reciprocating steam engines, and oil engines, both in lower horsepower classes, might be built by non-marine firms. These companies already have their tools. But new tools will be needed, and at that point the British program is certain to meet up with the Priorities Board.

Just how far the Administration will permit the British plants to interfere with U. S. Naval and Maritime Commission building programs depends on the extent of its conviction that our line of defense is the English Channel. Leaving that to Mr. Roosevelt and Congress and the turn of events, both Navy and the Commission say they can get along.

The Navy has loaded up all the big yards with its two-ocean order for war ships, but is about to distribute the balance: plane tenders, mine sweepers, tugs, rescue boats, etc., to smaller yards. Navy has filled in a big construction gap by the purchase recently of the entire fleet of 12 Standard Oil tankers—best and most modern oilers in the world; of 30 auxiliary and supply vessels, including several yachts; and of about 30 additional such vessels now being negotiated. These purchases include a number of the modern C-ships which were built by the Maritime Commission. The C-ships are readily convertible for Navy service. Navy says it is ready for action in the Pacific now.

The Maritime Commission admits it will meet with difficulties but definitely will maintain its 50-ships-a-year schedule. Navy will elbow the Commission out of some yards, when boats now building are completed, but ways will be added to some merchant-man-building yards, and some new plants will have to be built. The Commission, all told, has placed contracts for 174 ocean-going ships, most of them under construction subsidies Forty-seven are in service. The balance are 95 per cent completed and in case of emergency could be launched for Naval supply service.

There is something like a million tons of idle and de-commissioned shipping in the United States, much of it available to British purchase. Of the 111 World War laid-up ships owned by the Commission, Britain has taken 21, and other sales have reduced the ghost fleet to about 60. These and privately-owned idle ships sell for $300,000 to $500,000 apiece, and the British are likely to take many of them before they concentrate on building powered scows at a much higher figure. The Maritime Commission has no authority to sell any of its C-ships because the Government has a "mortgage" on them.

New Booklet Provides Information On Shows and Exhibits for 1941

NEW YORK—A new 34-page booklet containing information on American Shows and Exhibits for 1941 has just been published by Exhibitors Advisory Council, 120 Greenwich St., New York, N. Y. The booklet, which is sold at $5.00 per copy, is classified to cover 50 different industries and includes approximately 350 shows.

WILL MAKE JOHNSON RIFLE

PROVIDENCE, R. I.—The Universal Winding Co., Cranston, will begin manufacturing the Johnson automatic rifle in a few weeks. Company officials have established a separate unit known as the Cranston Arms Co., which employs 300 persons. Machinery has already been ordered and it is expected that production will begin in a month or so. No information is available as to who will purchase the rifle, but it is indicated by an official of the State Industrial Commission that "huge orders have been received from a very friendly country".

Aluminum Company of America Reduces Price of Aluminum Ingot

PITTSBURGH — Aluminum Co. of America will reduce the price of aluminum one cent per pound on Nov. 18. This brings the price of Alcoa aluminum ingot to 17 cents a pound. The present reduction in price is a continuation of a policy begun three years ago by the company. At that time it was announced that price increases would be avoided wherever possible. Aluminum Co. of America is engaged in an extensive expansion program, its output of aluminum will be in excess of 700,000,000 pounds in 1942.

Farm Tool Manufacture Improves Without Aid of National Defense

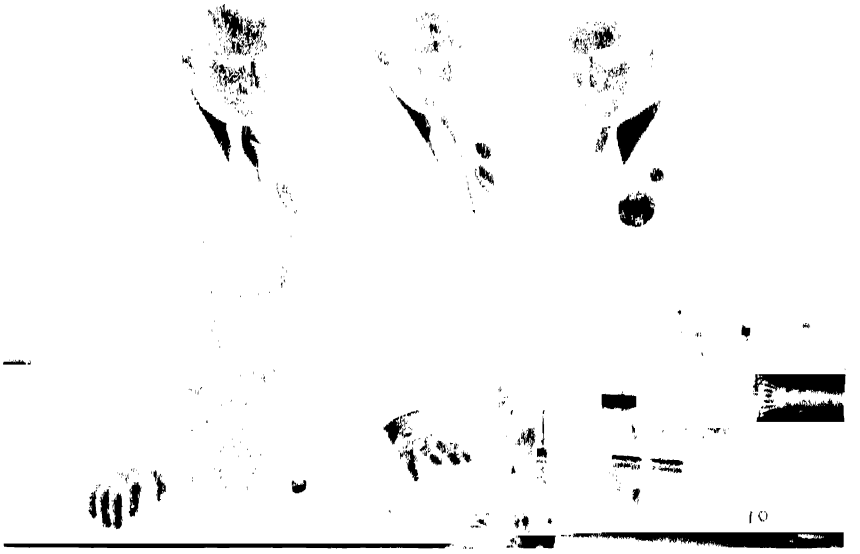
CHICAGO—Recent Department of Agriculture estimates indicate a total farm income of about $9,000,000,000 for this year, approaching the recent (since 1929) peak year of 1937. Farm mechanization continues at a good pace because of continued shortage of farm labor and low prices of farm equipment made possible by manufacturing improvements. Based on percentage of farm income which is usually spent on mechanization indications are that about $460,000,000,000 worth of equipment will be sold in this country. The excellent export business enjoyed so far this year bids fair to give the best record ever held in that division. Estimates are that exports may run $87,000,000. The combined total of manufacture, however, will not be quite up to the $571,241,883 total of 1937.

Other favorable factors for the farm equipment manufacturers are that many of them derive considerable business and revenue from the industrial tractor sales. Most of the manufacturers are experiencing a boom in present sales of industrial tractors. Caterpillar Tractor notably is running at full blast in Peoria.

Machine Tool Dealers, After Annual Convention, Inspect Monarch Machine Tool Co.



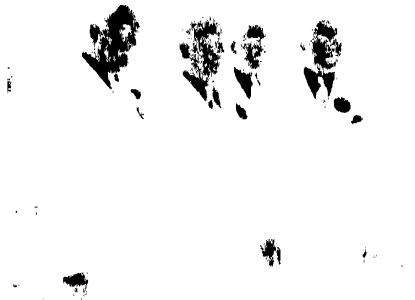
Interested—*In looking over a new development (above) were John Herkenhoff, Minster Machine Co., Minster, Ohio; W. F. Sandman, Marshall & Huschart Machinery Co., Indianapolis; A. G. Bryant, president, Bryant Machinery & Engineering Co., Chicago; and George F. Turner, The Strong, Carlisle & Hammond Co., Detroit, Mich. Wendell E. Whipp, Monarch's president, saw to it that all plant facilities and operations could be examined by the visitors. Other members of the company guided the dealers in their tour*



Inspection Tour—*At the close of the annual convention of the Associated Machine Tool Dealers at Dayton recently the Monarch Machine Tool Co. was host to the members at a party which included an inspection tour of the company's plant at Sidney, Ohio. Above, Fred C. Dull, Monarch's vice president and secretary; P. A. Abe, Monarch's vice president in charge of manufacture; and John Cetrule, Triplex Machine Tool Co., New York, examine some new tools in the plant*



Talking It Over—*Three good friends at the party are pictured above. E. P. Essley, E. P. Essley Machinery Co., Chicago, and Dan Harrington, Wilson, Brown & Co., New York, talk it over (but not too seriously) with George J. Zimmerman, president Strong, Carlisle & Hammond, Cleveland*



Attentive—*To the proceedings were J. L. Cochran, C. H. Gosiger Machinery Co., Dayton; Chris Baldenhofer, president and general manager, Thompson Grinder Co., Springfield, Ohio; Hugh Robinson, Monarch Machine Tool Co., Indianapolis; and Earl M. Wagner, Van Dyck Churchill Co., Philadelphia*

Machine Tool Exhibit Opened To the Public at Chicago Museum

CHICAGO—The machine tool area of the industrial exhibit at the Museum of Science and Industry in Jackson Park, Chicago, has been opened to the public. The exhibit is sponsored by the National Machine Tool Builders' Association. It was made possible by a contribution of Association funds and by contributions from a number of the members of needed equipment.

AID COMMERCIAL PLANES

WASHINGTON — Establishment of a priorities committee to coordinate commercial and military plane production does not indicate early restrictions on manufacture of commercial transports. Some weeks ago the Army began pushing the idea of an embargo on commercial plane production and the plan met opposition in the defense commission. The dispute was finally appealed to the President himself. FDR stood with the commission and it was decided that "a healthy air transport system is an important adjunct to national defense". The priorities committee was named to stand guard against Army attrition of commercial orders.

Full Canadian Armament Production Seen Late in 1941; Increase Government Plants

MONTREAL—Full production of armament in Canada won't be under way until some time in 1941, probably not until a year hence. Output will be at a rate of $1,500,000,000 annually in a country whose total production of manufactured goods of all kinds has been only a little more than $3,000,000,000 a year.

Most munitions manufacture thus far has been in a handful of privately-owned plants which started preparations before the war began. National Steel Car Corp., Canadian Car & Foundry and Dominion Foundries & Steel Corp. are among those companies. The bulk of the war program, however, is to be handled by government-owned plants, only a few of which already are in operation.

Production of 500-lb. aerial bombs will start in February in a huge plant being built "somewhere in Quebec." Normal output will be over 100,000 bombs per year. It will be the first time that aerial bombs of any kind, other than a few practice bombs, have been made in Canada. The long-range program will embrace all sizes and types of bombs. The weight will vary from 40 to 1,000 lbs. And the types from common high explosive bombs to aerial projectiles capable of piercing heavy armor plate. Canadian plants will be ready shortly to make 2-inch and 3-inch trench mortar bombs and .303 rifle grenades. Plans are being considered for production of anti-tank mines and depth charges

3,000 Tanks Ordered

Some barrels for Bofors guns are being made in Canada, and a few have been delivered overseas. Shipments of motor vehicles for military purposes are going forth at a rate of 400 a day. An order for 3,000 tanks of new design will be in production early next year. Bren gun carriers have started coming off Canadian assembly lines.

Preparations are continuing for switch of Canadian airplane factories from British to U.S. models as part of the Canadian-U.S. joint defense program. British Anson planes, however, will still be made in this country.

Efforts of a new union to get a foothold at several Canadian shipyards has interfered with production schedules. Work at Canadian Vickers was disrupted for nearly a week. The government ordered a poll of Vickers workers resulting in a vote for continuance of shop committees instead of union representation by a majority of two to one. Union members were ordered to return to work and complied.

Though problems about power and raw materials appear to have been solved for the present, through imposition of government control, machine tool supply" is still a worry Canada must get a steady flow of machines from the United States to supplement domestic output.

Contractors May Apply to Treasury For Amortization Privileges

WASHINGTON—The red tape of defense is shaping up. The Defense Commission has worked out procedures by which defense contractors wishing to take advantage of the five-year amortization of defense facilities can prove to the Treasury that they are entitled to do so. Three certificates are involved. First, a "certificate of necessity" will certify, on the say-so of the commission and the secretary of war or navy, that the facilities to be amortized are necessary for the national defense. If the manufacturer is being reimbursed by the government "directly or indirectly" for the new facilities, he will have to get a "certificate of government protection" stating that the contract protects the interest of the government in the future use and disposition of the facilities. Defense commission lawyers are of opinion that inclusion in the price of goods made for the government of an item for cost of new plant would constitute indirect reimbursement. Finally, if there is no such reimbursement, the contractor will need a "certificate of non-reimbursement" to prove to the Treasury that he doesn't need a certificate of government protection. Instructions for getting these certificates can be obtained from War Department district procurement officers, the Assistant Secretary of War, or the Judge Advocate General of the Navy.

Canadian Labor Training Schools Provide Many Skilled Workmen

MONTREAL—The training schools, operated by the provincial governments and financed by the federal government, have already turned out 8,000 graduates from the summer courses. The entire number have been absorbed by war industries, particularly the aircraft plants. At present 1,900 young men are being trained at 11 schools, taking a four months' course of intensive training. Within the year it is expected that these schools will have supplied the air force alone with 5,000 to 6,000 airplane engine fitters, air frame mechanics, and similar workers. Between 25,000 and 30,000 are to be turned out over the next year.

FORD GETS HUGE DEFENSE ORDER

WASHINGTON—Ford Motor Co. came into the armament picture last week when the War Department awarded it a contract of $122,323,020 for airplane engines. It is the first defense contract awarded to the Ford organization. The contract calls for more than 4,000 Pratt & Whitney engines. As a letter of intention was sent to Ford last September by the War Department, the necessary plant expansion has almost been completed. Production of engines should not be long delayed. Additional recent orders are: Wright Aeronautical, $11,436,042 for airplane engines; Colt's Patent Fire Arms Mfg. Co., $8,074,406 for infantry weapons.

Auto Output for Last Quarter May Show a 25 Per Cent Gain

DETROIT—Production and employment in the automobile industry appear headed toward an even greater degree of stabilization during the fall and winter months than was the case a year ago. Plant managers were particularly proud of the relatively stable employment achieved during the 1940-model year.

October production soared to a new record of over 500,000 cars and trucks, and retail sales are likewise climbing to new heights. Manufacturers are confident that assemblies need be cut back only a very few per cent in November and December in order to prevent over-stocking dealers during the winter months. Chevrolet, for example, will continue its 5,000 per day schedule indefinitely because demand is out-running production capacity. Even if that assembly rate is continued into the winter months, it appears now that dealers will not be overloaded when the spring sales bulge occurs. Incidentally, Chevrolet displayed its 200,000th 1941-model on Nov. 7.

Scattered sales reports for the month of October indicate the strength of the market. In October, Pontiac enjoyed the biggest month in its history, selling 27,217 cars, or 61.9 per cent ahead of a year ago. During the balance of the year, factory production will be maintained 60 per cent ahead of 1939. Two six-day weeks have been worked so far. The October production schedule was 30,000 cars, whereas November output is pegged at 28,600 and December at 27,500. Oldsmobile also set a new sales record for the month, showing a gain of 38 per cent over last year. Domestic shipments of Plymouth passenger and commercial cars during October set a new record at 63,000 units.

INSIDE DETROIT

Forthcoming bomber procurement program may be handled exclusively by the automotive industry. From 12,000 to 32,000 planes are involved. "Committee for Air Defense" has been organized

BY RUPERT LE GRAND, DETROIT EDITOR

DETROIT—Evidence exists that the projected bomber-procurement programs of the United States and British governments will be completely fabricated and assembled in the midwest, instead of the previously announced plan whereby the auto industry would make the parts for final assembly at West and East Coast plane plants.

There are several reasons for this declaration: (1) Washington sources report that the government has under consideration the erection of as many as fifteen plants, to be privately managed, for production of major sub-assemblies and for final assembly purposes, (2) Detroit executives close to the National Defense Commission say that there is talk of putting up two huge final-assembly plants somewhere convenient to the automobile industry, (3) Mr. Knudsen has stated that plane plants should be frozen at present or contracted dimensions to expedite production of orders now in their hands, (4) the huge size of the projected programs assigned to the automotive industry (now reported anywhere from 12,000—32,000 ships) involves too many engineering, manufacturing, inspection and possibly insuperable shipping problems for proper coordination between auto plants and far-distant aviation assembly plants, (5) the method of placing contracts with auto plants for bomber parts will undoubtedly be upon a basis foreign to the business methods of the aviation industry, (6) responsibility divided between two industries, each accustomed to its own production methods, can hardly be looked upon as the best method of getting results, and (7) the aviation industry is naturally jealous of intruders in a field which it nurtured through many lean years, while on the other hand the automobile industry is not one to take dictation when cutting corners for mass production. For these reasons, well-informed local sources expect Mr. Knudsen to place sole responsibility for the complete new bomber-procurement program upon the shoulders of those operating the auto, body, parts and related equipment industries.

This line of reasoning appears correct, to judge from the rapidly expanding activities of the "Auto Committee for Air Defense". This is the new shortened name for the committee set up in Detroit on Oct 25, at the joint meeting of the Automobile Manufacturers Association, the Automotive Parts & Equipment Manufacturers, Inc., and the Automotive Tool & Die Manufacturers Association To the top committee appointed at that time—Alvan Macauley, Edsel Ford, K T. Keller, C. E. Wilson, and C. C. Carlton—two new members have since been added William Brown, president of Briggs, will represent the body plants, and Irving Babcock, president of Yellow Truck & Coach, will represent the truck manufacturers Mr. Carlton is acting director of the committee.

Graham-Paige Building Leased

One of the committee's first acts was to lease the Graham-Paige administration building and part of the plant itself. This space will serve several purposes: (1) to house a large staff to be maintained by the committee, (2) to provide accommodations for possibly ten Air Corps officers, with Major James A. Doolittle expected to be liason officer between the Air Corps, the Auto Committee and the National Defense Commission, (3) representatives of the National Defense Commission and the British government may eventually be located there, (4) a complete display of bomber parts is now being set up in the former factory sales room of the Graham-Paige organization, and (5) complete bombers with all of their sub-assemblies and major parts will be arranged in the plant space so that prospective manufacturers of parts or sub-assemblies can study them in detail and then obtain the proper perspective of their function in the completed product.

HUGE PLANE PARTS CONTRACTS

DETROIT—Nobody can foretell just what the government contracts for aircraft parts will mean to the auto industry in dollars and cents until all cards are laid on the table. The 12,000 plane deal is said to be worth between two and three billions. Reporters asked Mr. Knudsen what the plane-parts program would mean to the industry, and he dismissed the query with "half a billion". It is likely that even he didn't know. By virtue of its size and complexity, the business will mean plenty of headaches. Just by way of comparison, the wholesale value of cars produced in the model year 1940 was $2,800,000,000.



The Only One—*Rustless Iron and Steel Corp., Baltimore, is the only manufacturing establishment devoted exclusively to the production of stainless steel. Recently the organization opened its new $2,500,000 plant addition. Above a specially designed charging machine withdraws hot ingots from the heating furnace and swings them to the mill table*



Open House—*The National Machinery Co., Tiffin, Ohio, recently invited the public in to see its plant. Manufacturing operations were continued as thousands of visitors passed by. The program was designed by the management to foster a better understanding of the close relationship between industry and the public. Above some of the visitors look over the machinery in one of the sections of the plant*

The Tucker Aircraft Corp., organized last May, occupies a building adjacent to that taken over by the Auto Committee for Air Defense. Tucker has just received a government order for $5,900,000 worth of gun-turret machinery and a $201,000 experimental order for development of an eight-cylinder air-cooled motor for training planes. Some Graham-Paige equipment is being used and more will be brought for arrangement in a straight-line production system. Another corner of the Graham-Paige plant is devoted to a hush-hush Navy contract.

Graham-Paige, of course, has given up auto manufacture. Surplus 1941 models are being disposed of by distributors. Its body plant at Wayne has been sold to Bendix Graham is now seeking national defense contracts, sub-contracts or machine work suitable for its remaining facilities, or failing these to lease plant space.

The activities of the Auto Committee for Air Defense are still in the embryonic stage, despite groundwork already laid. It will be a month or more before a complete staff can be assembled. Meanwhile, industry concerns are being encouraged to look over the parts on exhibit with a view to fitting their production into the existing scheme or using idle facilities.

The main job now is to spread the work so as to: (1) achieve an early start on actual production, (2) coordinate the production of several hundred components so that none are lacking at the proper time, (3) set up facilities for sub-assembly of the larger structures like wings, center-wing sections, fuselage, tail surfaces and rudders. Undoubtedly, the last will require new structures, new machinery, and these enterprises will have to be placed so that their bulky products can be moved readily to final assembly.

The actual size of the government's bomber program is not so important to the auto industry right now as determining the means to make the "pieces." Once the setup is made, it is confident that mass-production methods will take care of the situation. So far it has been given to understand that 12,000 bombers are wanted exclusively for the United States Army. Two types have been selected—a Martin two-engine 12-ton job, which actually has been designed for mass production by sub-assemblies, and a Douglas bomber.

The labor problem may prove to be the crux of the matter. An average of 426,000 men were employed in the auto, body and parts plants during the 1940 model year. Working in the most efficient industry in the country, the productivity of these men was doubtless far higher than can be realized in the plane program. If contracts to the auto industry run into several billions, the difficulty of finding and training men may prove the major factor toward influencing curtailment of automobile production.

Failure of Lewis to Resign Would Muddle Labor Picture

NEW YORK—The result of the presidential election has served to muddy the labor waters and only a forthright reiteration of his intention to resign by John L. Lewis will help to clear them. Already, within the C.I.O., there is a vocal and energetic movement to "Draft Lewis". Left-wing, Communist dominated unions and United Mine Workers payrollers who followed Lewis into the Republican camp are taking up a cry of "indispensability" clearly designed to buttress their own fallen prestige.

The majority sentiment in C.I.O. ranks wants to wish the bushy-haired leader well and retire him to pasture. They are convinced that his ability to serve the interests of organized labor is now over and they refuse to sentimentalize by keeping him. The Communists, on the other hand, look at Lewis as their protector for they are sure that at his retirement the anti-red Philip Murray of the Steel Workers and Sidney Hillman of the Clothing Workers will be dominant influences. Then too, all other important C.I.O. officials, who have a chance of succeeding Lewis, are committed to reinstitute unity in the labor movement between the C.I.O. and A.F.L. and it is hard to conceive of an arranged peace that would make the Communist leaders welcome in a combined A.F.L.-C.I.O. Hence, with Lewis out and the road to peace open, the Communist-led unions face isolation.

Not Easy to Oust Lewis

Nevertheless, if Lewis remains silent it will not be an easy job to unseat him. At this time there is no leader of adequate stature in the C.I.O. to place anyone but Lewis's name in nomination at the convention which meets in Atlantic City November 18. It is a safe bet to presume that Hillman will not do it. If he takes the lead in an anti-Lewis move it will be interpreted as a personal gesture and thus will lose much of its effect. Murray is a miner and is apt to be silent in all discussions of a successor to his chief; it is likely that he will only accept the nomination for the C.I.O. presidency if John L. Lewis O.K.'s it and if he is assured that there will not be serious opposition. Other labor bigwigs of comparable prominence will support a move to replace Lewis, but will not lead such a movement.

But even if Lewis leaves the presidency of the C.I.O. he will remain in control of the powerful United Mine Workers Union. Nominations for the presidency of the U.M.W. are already closed and the only other man nominated, Philip Murray, has declined which leaves Lewis as the only candidate for that office. As head of the Miners, Lewis will still exert great influence in the councils of the C.I.O.

WATCHING WASHINGTON

Roosevelt election will have an adverse effect on metal-working industry. U. S. will train 30,000 at technical colleges for defense needs. Tin, copper, and pig iron prices and supplies watched

By BLAINE STUBBLEFIELD

WASHINGTON—The election results will not cause any immediate change in metal-working operations. But the accomplished fact of Mr. Roosevelt's election will make a difference in the near future, because he will accept his third term as a mandate to reassert basic international and domestic policies which he had modified for political purposes.

The President undoubtedly will start at once to expand airplane and arms aid to Britain, on a scale perhaps almost equal to a war effort. In the Pacific, it is apparent the Administration has pulled its punches at Japan, in the hope that the Nippons will desert the Axis. But if Japan makes overt passes at British and American interests, the President might move to send important aid to China also.

There are several means by which Roosevelt can build up any size of campaign-short-of-war for England. If he can convince the country that our most vital outpost is Europe, he can divert much or most of our own defense production to Britain. What is now going on secretly in a small way would be done openly in a big way.

He can permit the British to set up their own plants in this country, to use American materials and labor. He can sell to the British an enormous amount of shipping and, by securing an Act of Congress, could sell considerable quantities of outmoded rifles, field guns, and several hundred airplanes in the possession of the United States Army. With a little more patriotic fervor to back him up, he could call for, and probably secure, repeal of the Johnson law forbidding credit to war-debt delinquents. This does not seem to be an early possibility. The bottom of Britain's money barrel is still well covered.

On the domestic side, Roosevelt faces substantially the same Congress that has heckled and blocked him for the past two years—except that slight Republican losses make more difficult the formation of any Republican-conservative coalition. But where, since 1938, Congressmen have felt that they were riding the tide in opposing the President, they have now learned that he can't be licked. Having re-demonstrated political strength, Roosevelt and his advisors will sit more tightly in the saddle.

Even in the absence, however, of new aid to the lower third, the New Deal climate will make itself felt in the handling of defense production. The trend may now be in the direction of increasingly rigid controls, scheduling, priorities, profit limits. Meanwhile manufacturers will find themselves dealing with a less irritating but more powerful labor movement. The discrediting of Lewis and consequent accession of Hillman to effective if not titular leadership of the CIO is bound to result in unification of the two factions.

Colleges Train Defense Labor

Special courses, to be given by colleges and engineering schools at Government expense, will be offered to over 30,000 students with technical backgrounds to meet industrial needs in the defense program. The plan, after some months of study by the Office of Education, is announced by Paul V. McNutt, Administrator of the Federal Security Agency. Congress voted $9,000,000 for the purpose.

Both full time and part time students will be accepted. Instruction will be the same as that given for regular degrees, but will concentrate on defense needs, and courses will require from 2 to 8 months of study. Faculties will be augmented by teachers specially qualified by experience in industries to be served.

First courses to be offered will be design to forestall potential shortages of inspectors, materials, chemicals, explosives, instruments, power units, designers of machinery, equipment, tools and dies, aircraft power plants, instruments, engineers, metallurgists, and naval architects, etc.

Conflict in Priority Orders

Most pressing problem now facing administrators of the voluntary priorities system is elimination of conflicts between priority orders. While it is not true that all defense orders now have the same priority, all aircraft orders do have A-1 rating; since this represents the biggest chunk of machine tool orders, it poses a problem. In theory, there should be no difficulty; a preference number merely requires that sufficient priority be given to an order to permit completion by the contract date. There have been a few cases in which orders for goods urgently needed to open up bottlenecks have been given an as-quick-as-possible delivery date—equivalent to stepping up priority a notch.

But in the haste to get contracts out insufficient attention was given to avoiding conflicts of delivery date. A restudy of the outstanding contracts to straighten this out by changing dates is now under way. Some sub-division of preference classifications (A-1-A, A-1-B, etc.) may also be adopted.

There is a certain amount of industry pressure for some easy system by which a sub-contractor might obtain a higher priority than his prime contractor. Except in the case of machine tool subcontracts, however, this plea is not obtaining a sympathetic reception. It is still intended, however, to give a high priority to the orders for machine tools given by machine tool builders.

All of this thrashing out of difficulties, as well as drafting of a code of regulations, is now in the hands of the Army-Navy priorities committee. The Defense Commission's priority board will have the final say.

Pig Iron, Copper, Tin Watched

Three strategic metals came to the notice of Washington in the past fortnight. The price of pig iron became a matter of concern to the Defense Commission but a continuing supply at current levels seems probable. Defense consumption of copper is outrunning domestic production and importation from U.S.-owned South American mines is being considered by the Commission. There is a question whether the import levy of 4 cents a pound could be reduced by executive order, since it is not a tariff but is an excise tax.

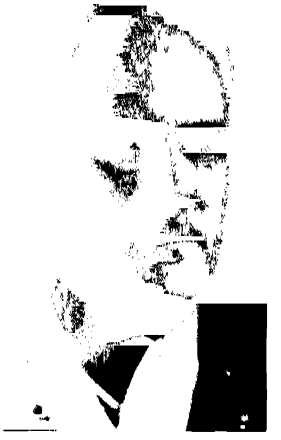
NAVY BUYS SHOP EQUIPMENT

WASHINGTON—Navy expenditures for shop equipment, including machine tools, for Navy yards in the fiscal year 1941 will be as follows: at Portsmouth $1,650,000; Boston $1,675,000; New York $2,200,000; Philadelphia $1,200,000; Norfolk $1,500,000; Charleston $825,000; Mare Island $1,100,000; Puget Sound $1,100,000; Pearl Harbor $1,150,000; and Cavite $75,000. Much of this business has been placed.

United States Government Arsenal Commanders Who Have Been Promoted to Rank of Brigadier General



EDWARD M. SHINKLE



NORMAN F. RAMSEY



ROLLAND W. CASE



ALEXANDER G. GILLESPIE

Six Arsenal Commanders Promoted By U.S. as Army Expands Rapidly

WASHINGTON—Commanders of six government arsenals have been promoted from the rank of Colonel to that of Brigadier General The arsenal commanders are Edward M Shinkle, Picatinny, Gilbert H Steward, Springfield, Rolland W Case Watertown, Norman F Ramsey, Rock Island, Alexander G Gillespie, Watervliet, and Walter P Boatwright, Frankford

Brigadier General Shinkle joined the army after graduation from West Point in 1901 He was detailed in the Ordnance Department in 1906 and served at Sandy Hook Proving Grounds, N J He has served in the office of the Chief of Ordnance in Washington and commanded the Aberdeen Proving Ground, Md, during which time he was appointed Assistant Chief of Ordnance He assumed command of Picatinny Arsenal in 1938 where he has served as Colone until his present appointment

Brigadier General Case has commanded the Raritan Arsenal N J served as Ordnance Officer and Assistant Chief of Staff at Omaha Neb In 1937 he became commanding officer at Watertown Arsenal

Brigadier General Gillespie served at the Aberdeen Proving Ground and Raritan Arsenal He was appointed assistant and later became commanding officer at Rock Island Arsenal Later he was designated as Ordinance Manufacturing Arsenal Commander at Watervliet Arsenal

Brigadier General Ramsey served as assistant Chief of Ordnance from 1912 to 1916 He was chief ordnance officer of the A E F He had charge of manufacturing at Rock Island and in 1937 took command of the arsenal

U. S. Government Contracts Awarded to Metal-Working Firms

	Agency	Commodity	
Le Tourneau Co, Toccoa Ga	War	Artillery ammunition components	$4 569 290
Tennessee Coal Iron & R R Co Birmingham Ala	War	" " "	5 823 600
Coslin Birmingham Mfg Co, Inc, Birmingham Ala	War	" "	1 740 000
Landis Machine Co St Louis Mo	War	"	769 100
S A Woods Machine Co Boston Mass	War	" " "	846 000
Carter Carburetor Corp St Louis Mo	War	"	1 076 001
Budd Wheel Co Detroit Mich	War	" "	7 818 380
Pullman Car Mfg Co Chicago Ill	War	"	2 825 090
Murray Mfg Corp Brooklyn N Y	War	" "	840 000
Tube Turns Inc Louisville Ky	War	" "	668 610
Pullman Car Mfg Co Butler Pa	War	"	1 590 000
Willys Overland Motors Inc Toledo Ohio	War		8 820 040
Omaha Steel Works Omaha Neb	War	"	2 955 750
Taylor Wharton Iron & Steel Co Walton, Pa	War	" "	2 721 240
Bauer Brother Co, Springfield Ohio	War	"	2 337 740
Mullins Mfg Corp Warren Ohio	War	"	1 980 300
Revere Copper & Brass Co Chicago Ill	War	" "	2 160 000
Philco Corp Philadelphia Pa	War	" "	2 098 600
Federal Screw Works Detroit Mich	War	" "	1 249 500
Hoover Co North Canton Ohio	War	" "	3 923 300
Bridgeport Brass Co Bridgeport Conn	War	" "	1 120 000
Scovill Mfg Co Waterbury Conn	War	"	2 821 504
A & J M Anderson Mfg Co Boston Mass	War	"	1 570 800
Bethlehem Steel Co Bethlehem Pa	War	" "	785 000
Warren Webster & Co Camden N J	War		663 000
Wright Machine Co Worcester Mass	War	"	1 091 400
Electric Household Utilities Corp Hurley Machine Div Chicago Ill	War	" "	755 590
Chicago Roller Skate Co Ware Brothers Div, Chicago Ill	War	"	978 110
Electric Auto Lite Co Toledo Ohio	War	" " "	748 000
Emerson Electric Mfg Co St Louis Mo	War	"	822 242
Federal Screw Works Detroit Mich	War	" "	1 048 500
International Harvester Co Chicago Ill	War	" "	554 000
General Railway Signal Co Rochester N Y	War	" " "	1 400 000
Edward G Budd Mfg Co Philadelphia Pa	War	" "	574 793
American Brass Co Waterbury Conn	War	Small Arms and ammunition	1 035 880
Revere Copper and Brass Inc Baltimore Md	War	" " " "	661 660
Jack-Heintz Ltd, Palo Alto Calif	War	Starter assemblies	2 535 367
Buda Co Washington, D C	Navy	Engines for power boats	674 062
Lukens Steel Co Coatesville Pa	Navy	Steel plates	889 024
Worth Steel Co Claymont Del	Navy	Steel plates	1 343 095
Carnegie Illinois Steel Corp, Washington D C	Navy	Steel	4 980 464
General Machinery Corp Niles Tool Works Div, Hamilton Ohio	Navy	Planers	571 200
Gulberson Diesel Engine Co Harvey Ill	War	Engines	2 915 095
Lockheed Aircraft Corp Burbank Calif	War	Airplanes	30 278 787
Parish Pressed Steel Co Reading Pa	War	Carriages	1 674 591
American Locomotive Co New York N Y	War	Carriages	1 427 206
Consolidated Aircraft Corp San Diego Calif	War	Airplanes	85 008 000
Bausch & Lomb Optical Co Rochester N Y	War	Height finders	1 797 465
Bendix Products Div Bendix Aviation Corp South Bend Ind	War	Aircraft armament	12 671 030
Yellow Truck & Coach Mfg Co Pontiac, Mich	War	Trucks	717 988
Sperry Gyroscope Co Brooklyn N Y	War	Indicator and controller assemblies	9 961 240
Bendix Aviation Corp Bendix N J	War	Indicator and tube assemblies	3 186 315
Goodyear Tire & Rubber Co Akron Ohio	War	Brake & wheel assemblies	1 531 331
Lansdowne Steel & Iron Co Morton Pa	War	Ammunition components	17 283 750

Promoted at G-E Philadelphia Works



ROBERT PAXTON



HAROLD E. STRANG

Metal Treaters' Prexy



CHARLES I. WESLEY

Oldsmobile Prod. Mgr.



R. E. GRIFFIN

NAMES in the NEWS

R. S. Clingan has been appointed Chicago District Manager handling Aristoloy Steels for Copperweld Steel Co., Warren, Ohio. For the past ten years Mr. Clingan has been connected with the Republic Steel Corp.

R. E. Griffin has been appointed to the position of production manager of Oldsmobile. Mr. Griffin, one of Oldsmobile's veteran employees, started his career in the service department in 1916. He was assistant service manager for several years and in 1921 took over the management of the distribution department which he held until his present appointment. T. R. Taffee, formerly assistant manager of that department, succeeds Mr. Griffin as manager.

Robert Paxton, formerly managing engineer of the Panel & Equipment Div., has been appointed assistant to the Works Manager in the Philadelphia Works of the General Electric Co. Harold E. Strang, formerly managing engineer of the Large Power Circuit Breaker Div., has been appointed engineer of the Philadelphia Works. L. S. Hobson was appointed managing engineer of the Power Circuit Breaker Div., and George M. Reed succeeds Mr. Paxton as managing engineer.

Ray R. Toepel has been named manager of the Brillion Iron Works, Inc., Brillion, Wis.

Harold B. Thomas, one of the founders of the Elastic Stop Nut Corp., Union, N. J., and vice-president in charge of sales, has resigned to enter consulting work in industrial product analysis and market research. Mr. Thomas remains active as a director and member of the executive committee of the corporation.

H. H. Timken, Jr., has been elected chairman of the Board of Timken Roller Bearing Co. to succeed his father, the late H. H. Timken, Sr. Mr. Timken will continue as vice-president and general manager of the Steel Div. John E. Fick, general superintendent of the steel division has also been elected to the Board. George W. Curtis has been appointed Milwaukee Div. manager of the company. Industrial and Automotive bearing sales as well as Alloy Steel sales activities of this division will be under his supervision.

Charles I. Wesley, president of the Wesley Steel Treating Co., Milwaukee, has been elected president of the Metal Treating Institute, Inc. of America, and N. M. Salkover, Cincinnati, has been elected vice-president. Arthur H. Nuesse, secretary of the Wesley Firm, was named National Secretary.

PLANT EXPANSION

Cutler-Hammer, Inc., Milwaukee, manufacturers of electrical equipment, has opened a new factory at San Francisco.

Curtiss-Wright Corp. will expand its St. Louis Aircraft plant six-fold. Scheduled to be completed late next spring the new plant will turn out $70,000,000 national defense orders recently received for military planes. The new building will have 1,200,000 sq. ft. of floor space and will cover 27 acres adjoining the present plant.

Bullard Co., Bridgeport, Conn., manufacturer of machine tools, has completed construction of a large foundry extension. The expansion will provide additional facilities to fill orders resulting from the National Defense Program.

Hoover Co., North Canton, Ohio, will construct a new $125,000 factory building in order to manufacture shell fuses for the United States Army Ordnance Department.

Hercules Powder Co., Radford, Va., will construct additional facilities for its plant. The expansion is valued at approximately $10,000,000 and brings the total cost of the plant to about $35,000,000. This will increase production by approximately 50 per cent.

Charles Bruning Co., Chicago, manufacturers of drafting engineering supplies and equipment, will build a new plant valued at $278,000. The plant is scheduled to be completed in about five months and will double the company's Chicago capacity.

Bastian-Blessing Co., Chicago, manufacturers of welding equipment, will construct a $500,000 plant for the manufacture of new equipment.

The American Rolling Mill Co., Middletown, Ohio, has begun a $5,000,000 plant improvement program for the purpose of effecting substantial operating economies and treating production. The program includes the construction of a cold reduction mill at the Armco plant in Middletown, at an estimated cost of $3,800,000.

Boeing Aircraft of Canada, Ltd., at Sea Island Airport, Vancouver, B. C., will erect a new plant with the aid of government funds. The expansion, which will cost at least $1,500,000, will cover approximately 28 acres of ground.

Joy Mfg. Co., Franklin, Pa., will add improvements costing $200,000 at two of its plants.

W. C. Lipe Inc., Syracuse, N. Y., is constructing an addition to its plant to provide for expansion of the machine tool division.

Rollway Bearing Co., Inc., Syracuse, N. Y., will erect an addition to its existing plant to provide the needed capacity for expanding business. The new building will be devoted to bearing assembly and shipping facilities.

Louis Allis Co., Milwaukee, is erecting a new factory building, 90 by 100 feet, at a cost of approximately $16,000.

Kempsmith Machine Co., Milwaukee, has opened a machine tool branch in Whitewater, Wis. The office is under the management of Robert W. Stevenson.

King Machine Co., Milwaukee, has purchased the Wisconsin Gray Iron Co. building and will also erect a $20,000 addition.

Colonial Broach Co., Detroit, has begun the construction of a new plant which will provide some 20,000 sq. ft. of manufacturing space. The addition is scheduled to be completed about January.

Cramp Shipbuilding Co., Philadelphia, has been authorized by the Navy Department to begin the expenditure of $10,000,000 to restore the shipyard for national defense work. Machines to cost $1,000,000 will be needed to retool the plant. The firm already has a $120,000,000 Navy order for six cruisers.

To further expand its aircraft engine production Wright Aeronautical Corp. has leased the plant of the National Dyeing and Printing Co., East Paterson, N. J. The 433,000 sq. ft. of new space will be used to build cams and gears for engines. The company now employs 13,000 and has a plant area in and near Paterson of 2,800,000 sq. ft.

BUSINESS ITEMS

Campbell Machinery Co., Detroit, has been reorganized under the ownership of C. L. Campbell.

Hammond Machinery Builders, Inc., Kalamazoo, Mich., has purchased the Automatic Polishing and Buffing Machinery Division of the Continental Roll and Steel Foundry Co., East Chicago, Ind. The latter organization is now operated in Kalamazoo.

OBITUARIES

Charles L. Allen, 82, chairman of the board, Norton Co., Worcester, Mass., died at his home November 4. Mr. Allen, who served as general manager of the company for 48 years until his retirement from that post in 1933, was regarded as the dean of Worcester industrialists.

In 1881 Mr. Allen started with the Norton Co. as a bookkeeper. At this time the company was a struggling pottery shop employing 13 men. An experiment in making a grinding wheel led to the vast organization which now employs over 6,000 workers. The Norton Emery Wheel Co. was organized in 1885 and Mr. Allen was made its first general manager. In 1892 he became secretary and director of the company and in 1912 its treasurer. When the Norton Co. and the Norton Grinding Co. were merged in 1919, Mr Allen was elected president and general manager of the Norton Co.

When Mr. Allen retired from the administrative leadership of the company in 1933, he became chairman of the board. With his finger still on the pulse of the business, and his years of experience at the disposal of the management, Mr. Allen remained a leading figure in the company. He was also interested in Norton subsidiaries, including Berh-Manning Corp., Troy, N. Y., and Norton Pike Co. of Littlefield, N. H.

Carl Arvid Edlund, 45-year-old manufacturer, died recently as the result of an accident. Mr. Edlund was president of the Edlund Machine Co.

Thomas F Howarth, vice-president of the Simonds Saw & Steel Co., Fitchburg, Mass., died recently after a brief illness. He was 77 years old at the time of his death. Mr. Howarth joined the company as an office boy and worked himself up to an executive position. He served ten years with the company's San Francisco office.

John P. Danielson, 75, nationally-known tool manufacturer and president of the J. P. Danielson Co., Jamestown, N. Y., died recently after a brief illness. Mr. Danielson started his career as an industrialist in 1902 and was active up to the time of his illness.

Robert S. McManus, prominent figure in the nation's structural steel industry for many years, died suddenly in his home in Buffalo. He was 57 years old. Mr. McManus was president of the R. S. McManus Steel Structural Co. Inc., Buffalo, and he supervised the construction of numerous buildings, mills and factories throughout the East.

Industrialist Dies



CHARLES L. ALLEN

Herman W. Koerner, 79, president of the Universal Wire & Iron Co., Milwaukee, died recently. Mr. Koerner, with his son Elmer, organized the business in 1919.

Emil Vilter, 69, chairman of the board of the Vilter Manufacturing Co., Milwaukee, died Oct. 30. Mr. Vilter served as president of the company from 1919 until 1934 at which time he became chairman of the board.

Charles Fred Morley, machinery manufacturer, who was widely known as an authority on shell manufacture and often adviser on ordnance munitions to the War Department, died recently at the age of 56. At his death he was president of the Morley Machinery Corp., Rochester, N. Y. In 1920 Mr. Morley founded the present corporation which bears his name. Since then he has been frequently called to Washington for consultation on matters pertaining to shell manufacture. In 1933 he was on duty as consultant in the office of the Assistant Secretary of War and in 1936 at the Frankfort Arsenal.

MEETINGS

American Society of Mechanical Engineers. Annual convention. New York, N. Y., Dec. 2–5.

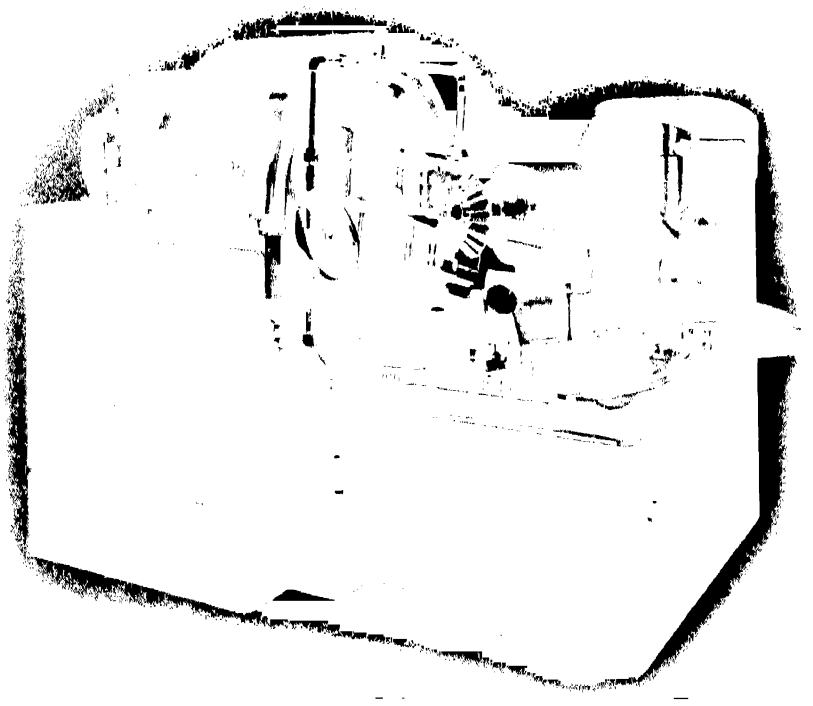
Motor & Equipment Manufacturers Association. Annual meeting. Blackstone Hotel, Chicago, Ill., Dec. 10.

National Exposition of Power and Mechanical Engineering. Grand Central Palace, New York, N. Y., Dec. 2–5.

Society of Automotive Engineers. Annual meeting, and engineering display. Book-Cadillac Hotel, Detroit, Mich., Jan. 6–10, 1941.

SHOP EQUIPMENT NEWS

Gleason Straight Bevel Gear Generator Cuts Teeth up to 50 Per Cent Faster



It is said to be possible to cut smoother, quieter running straight bevel gears up to 50 per cent faster with the No. 24 straight bevel gear generator introduced by the Gleason Works, Rochester, N. Y. This machine will handle gears up to 35½ in. in diameter and with pitches as coarse as 1½ D.P.

Generating principle is that of a relative rolling motion between the reciprocating tools and the gear blank. New type tool relieving mechanism and tool slides provide rigid tool support and permit higher stroke speeds than previously possible on machines of this size. Tool-slide ways are of cast iron, working against hardened steel. Fully inclosed cradle is mounted on anti-friction bearings in a rigid housing. Cradle reverse and index mechanisms are cushioned to give fast, smooth, quiet operation.

Heavy work head is secured to a large base which slides on a heavy one-piece frame. Feed for tooth depth and withdraw for indexing are applied to the sliding base through a cam and adjustable lever. Cam has a double track, one track for rough cutting and the other for finish cutting. Hyraulic in-and-out mechanism provides rapid movement of the work head.

Standard spindle is bored to 6 in. nominal diameter at the large end, with ¾ in. per ft taper to facilitate chucking large-shank jobs and to permit faster cutting because of increased rigidity A new type of universal stock dividing gage accommodates all pitches within the machine range, and can be used for either even or odd numbers of teeth.

Gearing is made with increased accuracy to insure more accurate tooth profiles Adjustments of feed and speed rates, the index, the ratio of roll, and the amount of roll are all obtained by change gears for fast and easy set-up. Automatic lubrication is provided.

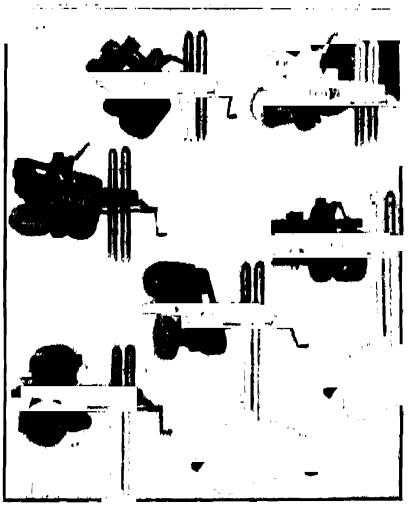
Specifications: Maximum cone distance, 17¾ in.; maximum pitch angle, 84 deg 18 min.; minimum pitch angle, 5 deg. 42 min.; ratios, 1:1 to 10:1; maximum face width, 6 in.; index range, 10 to 200 teeth; floor space required, 74 x 105 in.

Murray-Way Buffing Head Pivots to Any Position

Murray-Way Corp., 253 Vinewood, Detroit, Mich., has developed a line of buffing heads which can be quickly adjusted to any wheel position for successive and production finishing, and which can be used in combination with dial type, indexing or continuous rotation dial machines, or with a continuous straight-line conveyor. Entire drive is mounted on a turntable which has a full 360 deg. of movement. Turntable and ring assembly, as a unit, is swiveled in the yoke member having, in the opposite plane, a full 360 deg. adjustment. Thus the wheel may be oriented in any position, there being absolutely no blind spots.

Besides the rotation of these two members, the entire head assembly may be moved vertically on the two columns which, in turn, have a swivel and lateral adjustment in the base. All these adjustments are made easily through cranks.

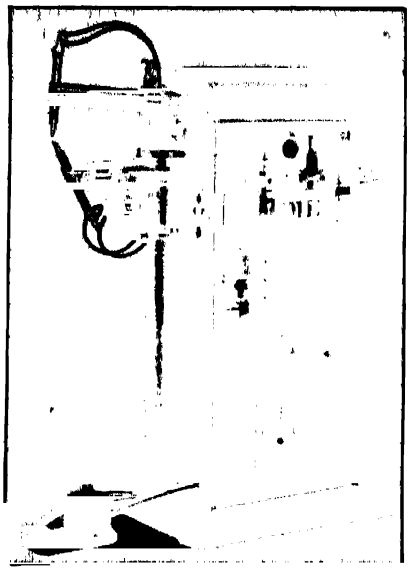
Buffing spindle is full floating, with adequate means for taking up wheel wear and maintaining predetermined work pressure. Dial table has a constant index time, but time of dwell



is varied over a wide range by electric controls. Timing device is graduated in seconds and minutes. All indexing mechanisms and fixture drives are completely enclosed and operate in an oil bath.

Acme "Hot Spot" Welder Has 48 Regulation Points

From 6 to 48 points of regulation are available on the Type 3 "Hot Spot" welder built by Acme Electric Welder Co., 5621 Pacific Blvd., Huntington Park, Calif. Available in capacities from 10 to 75 kva., these welders come completely equipped with automatic timers and magnetic contactors.



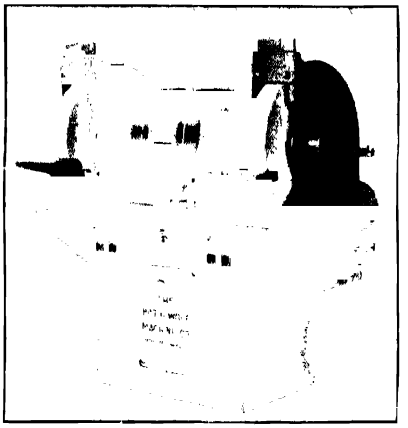
They are offered in various styles, actuated by a foot valve and limit switch, by a solenoid operated mushroom type floor switch or by a specially designed two stage toe-operated floor switch They are made for either single spot or automatic repeat operation

Features include heavy fabricated steel base, transparent bowl, pulsating type lubricator, jewelled pressure gages, bronze pressure regulators, test switches and piston packed cylinders

Hisey-Wolf Pedestal Grinder Furnished With New Guards

Hisey-Wolf Machine Co, Cincinnati, Ohio has developed a 5–7½-hp pedestal grinder which can be supplied with new guards designed in accordance with standards adopted by the American Foundrymen's Association These new machines are built in 18- and 20-in wheel sizes, with motor totally inclosed and ventilated through the pedestal

It is claimed that it is impossible for work to jam between wheel and guard, as the guard extends far beyond the periphery of the wheel Flange on outlet makes an easy connection to a dust collecting system



Defiance Boring, Drilling and Milling Machine Provides Large Number of Spindle Speeds

Defiance Machine Works, Inc, Defiance, Ohio, has developed the No 25-A horizontal boring, drilling and milling machine to provide an exceptionally wide range of spindle speeds The 3¾ in diameter spindle normally has twenty speeds ranging from 12 to 1,000 r p.m, and can be equipped with an additional low-speed arrangement giving twenty more speeds ranging from 4 to 420 r p m This low-speed device does not reduce the high speeds of the spindle Spindle sleeve rotates in Timken roller bearings Shave finished helical gears are used in the head

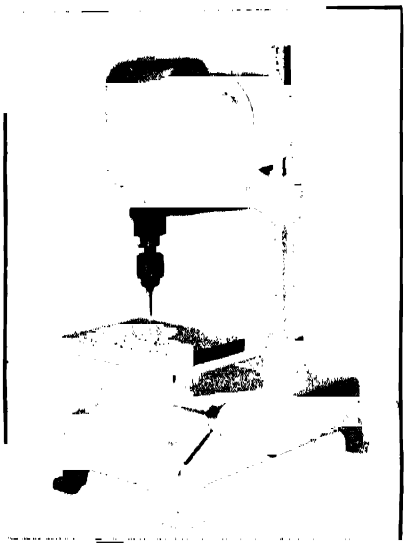
An outstanding feature of the machine is that the outboard supports under the table are integral with the base These supports consist of hardened tracks and hardened steel rollers with compensation for wear Base is extremely broad and is well ribbed for rigidity Standard table is 30x60 in, with a full 60-in cross travel

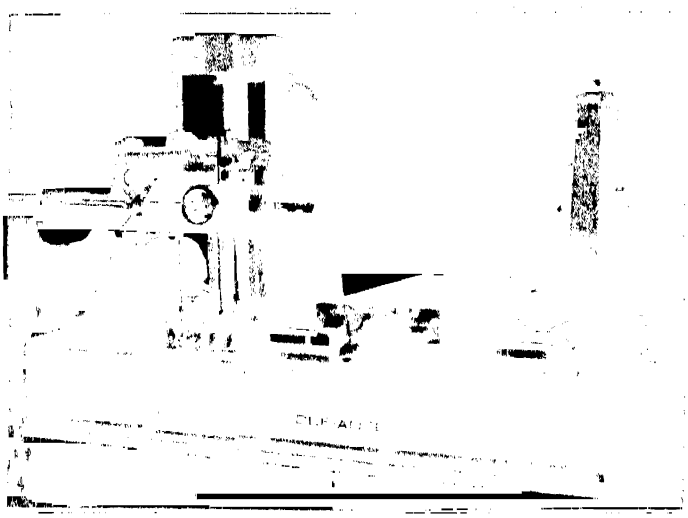
Control is simplified, as the levers are reduced to a minimum and located within easy reach of the operator Speed, feed and head units are force lubricated Spindle, shafts and gears are made of heat-treated alloy steel Oversize construction has been used throughout to provide utmost strength, rigidity, accuracy and freedom from vibration

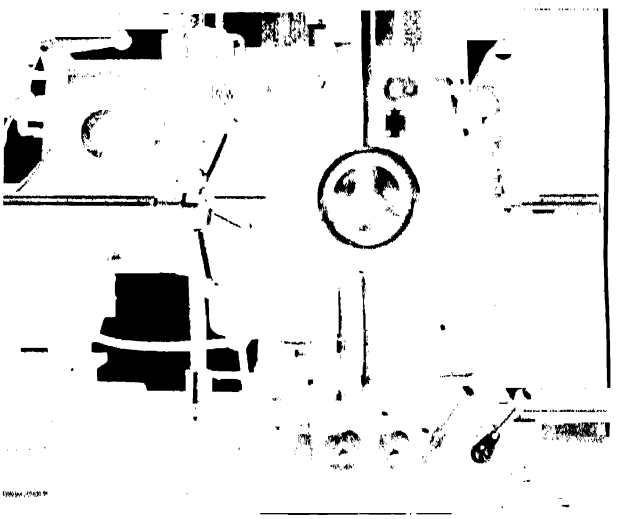
Machine shown is available in 5, 6, and 8 ft bed lengths and with 30, 36, 42 and 50 in head travel A variety of tab'e sizes can be obtained A dial indicator indexing device for the head and table movement is offered as an accessory Verniers for these movements are also available

Sensitive Production Tapper Made Available by Marburg

Marburg Bros, Inc, 90 West St, New York, N Y, has made available a sensitive production tapper built by E V Haffling Co, Bridgeport, Conn Developed to meet the needs of manufacturers of electric shav-







ers, clocks and other small precision mechanisms, this machine includes a super-sensitive friction clutch which can be set to such a degree that the tap will instantly stop whenever any predetermined tension between tap and job is reached.

In operation, the operator merely raises the table by hand or foot until the tap has started tapping. When the predetermined tension is reached the tap automatically stops cutting. Lowering the table engages the reverse clutch and withdraws the tap from the work. Machine is claimed to be of particular advantage when tapping plastics or other delicate parts which may break should the tap strike bottom. It is also said effectively to reduce tap breakage.

A simple adjustment changes the tapper into a power screw-driver Machine comes complete with reversible motor, double clutch, tension spring, vertical spindle and chuck for tap. Standard equipment also includes feed table with hand and foot lever

Shell Tapper Built by Landis Machine Handles Sizes Ranging From 75 to 155 mm.



Landis Machine Co, Waynesboro, Pa, has make available a machine designed especially for tapping the nose end of shells ranging from 75 to 155 mm. in diameter This "Landmaco" No 1½ R shell tapper possesses all features of other "Landmaco" threading machines, plus others to assure exceptionally accurate tapping on an unusually high production basis.

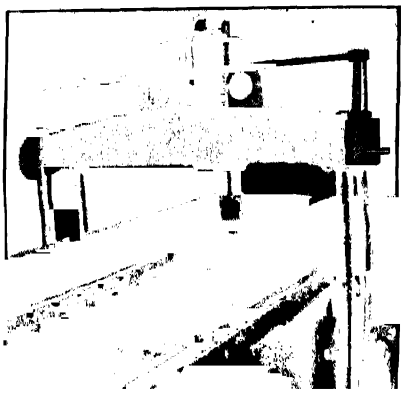
Special carriage or holding device with which the shell tapper is equipped comprises a work supporting cradle, hardened and ground bushing which supports the nose end of the work, and female center which supports the base end of the work. This female center is in alignment with the center of rotation of the machine spindle Movement of the center is actuated by an air cylinder mounted at the rear of the carriage, and is controlled by a conveniently located lever. In operation the center pushes the work forward until the work sets firmly in the ground bushing supporting the nose end. This effects a locking action which holds the work rigidly in alignment for tapping Female center and air cylinder are adjustable for shells of various lengths. In effecting set-up changes, for handling shells of different sizes, it is necessary merely to interchange the bushing which supports the nose end, the work supporting cradle, and the female center for those of the correct size.

Machine spindle is equipped with a special collapsible steel tap having all parts either hardened or heat-treated and precision ground Tap design provides for internal ducts through which coolant is conveyed directly to the cutting edges of the chasers The tripping collar also functions as a pilot to assure maintenance of unusually close tolerances for alignment of thread and body Collar is ground to a running fit within a pilot bushing located at the front of the machine carriage adjacent to the bushing and supporting the shell nose This pilot bushing operates in anti-friction bearings to minimize wear

In operation the collapsing action of the tap is actuated by the tripping collar striking the end of the work. Thus danger of chasers striking the shoulder at the bottom of the work to cause breakage is eliminated Furthermore, threads are held within very close tolerances for over-all length Production is estimated to average 90 to 115 shells per hour, based on an operating efficiency of 100 per cent

Brinell Hardness Tester Inspects Wide Plates

Detroit Testing Machine Co., 9390 Grinnell Ave, Detroit, Mich, has introduced a Brinell hardness tester for inspecting wide plates at any point without removal from the conveyor. This machine consists of a flat base (not shown) and cross-rail assembly supported by four posts. The test

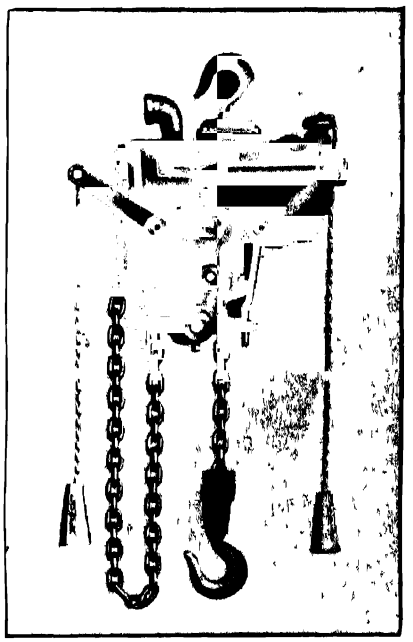


cylinder is mounted on a carriage sliding between the rails and is moved across the plate by a small motor operated by pushbuttons. Conveyor section, ordinarily furnished with the machine, runs between the posts Test ram travel is sufficient to contact the work without any adjustment other than movement of the operating lever Long stroke feature is available in standard units up to 24 in. stroke Distance between posts is almost unlimited

A heavy work-support rail runs between the conveyor rollers slightly below flush when idle. When a test is being made this rail is brought into contact with the bottom of the plate to take the load. In operation the plate passes over the rollers the desired distance and is held in that position by the work-support rail. Tests are then made across the width. Plate is then released, moved forward and testing is repeated

Small "Air-Bloc" Hoist Lifts 700-Lb. Load

For lifting loads weighing up to 700 lb, Ingersoll-Rand Co, Phillipsburg, N J, has introduced the "Air-Bloc" hoist A flexible welded link chain hoist for use in machine shops, assembly lines, maintenance shops,



shipping and repair departments, this hoist is available in three sizes designed to handle loads of 300, 500 and 700 lb., respectively.

The unit weighs less than 75 lb., and can be easily moved from one job to another. An automatic up-and down-stop control prevents damage to the hoist from over-run of chain in either direction. Another safety feature prevents the load from dropping even if the air supply fails. Hoist is powered with a four cylin-

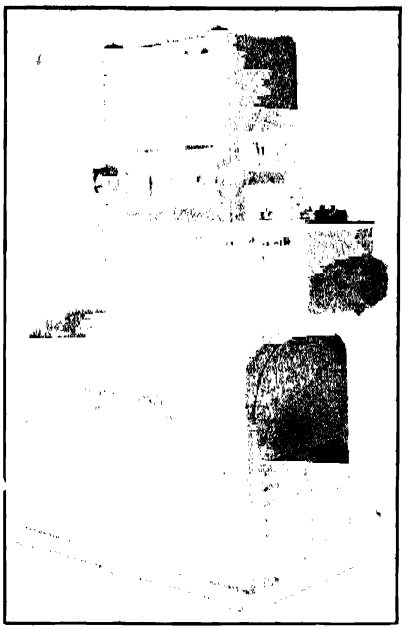
der radial air motor which, it is claimed, cannot be damaged by overloading. Sensitive throttle control permits easy and accurate spotting of the load.

Welding Rod Feeder Devised by Moslo

Moslo Machinery, Inc., 5005 Euclid Ave., Cleveland, Ohio, has developed a welding rod hopper feeding machine to pass straightened and cut welding rods into an extrusion press for application of coating material. A capacity of about 500 lb. of rods is provided.

Guide plates of feeding mechanism are arranged so that adjustment is obtained from a single hand screw, with positive adjustment assured. Thus it becomes possible to feed from the smallest to the largest diameter rods without fear of interrupted flow because of misalignment. Speed is controlled through an adjustable Reeves drive, permitting matching of feeding speed to that of any extrusion press

Feeder rolls are placed in a vertical plane while support shafts are in a horizontal plane, improving accessibility. Pickup rolls have a single hand screw adjustment so that movement in or out is simultaneous. Feed pressure is maintained through a heavy-duty spring Adjustment of



wire with guide tubes is always maintained, permitting full compensation for roller wear.

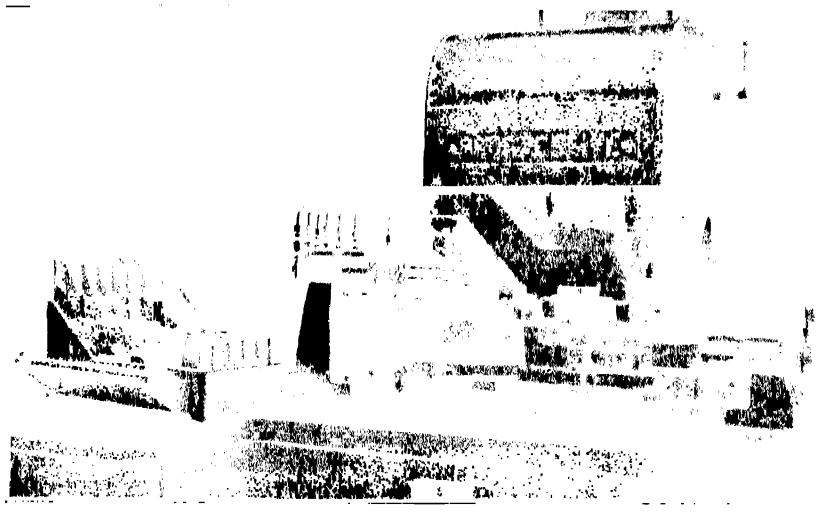
Drive mechanism is totally inclosed, running in oil on Timken roller bearings Hardened alloy steel gears and large bearings are used. Feeder is supplied in three hopper sizes to take wire in 18, 24 or 36-in. lengths. Machine is capable of handling any length up to its maximum.

Rubber-Tired Fixtures Speed Up Spot Welding

Use of rubber-tired movable jig fixtures which form the lower electrodes during welding, as offered by Progressive Welder Co , 3001 E. Outer Drive, Detroit, Mich., enables some 1,000 stampings to be assembled with 4,000 spot welds into 100 complete radiator grille halves per hour in the plant of a leading automobile company. Other features which increase production include: multiple spot welding in series with 20 guns per station, each having two self-equalizing tips; equal pressure to all welding guns through use of a "Hydr-O-Matic" welding unit; complete automatic operation, including automatic locating of the movable jig; and elimination of hand clamping.

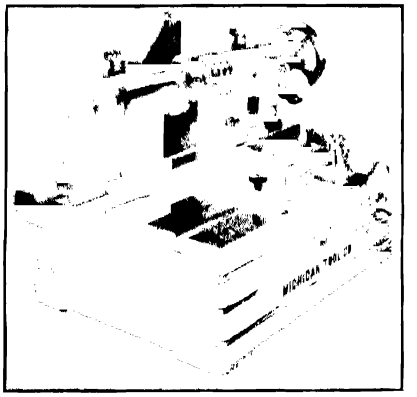
Welder has two dual stations. Two jigs mounted on rubber-tired wheels are used at each station Both stations are manned by two men. Each man handles one of the movable jigs which he loads, shoves into machine for welding, and pulls out for unloading. Thus while one operator is loading his jig the second operator is welding.

In operation, a jig is loaded and is moved into welding position. Guides and locking pins on the table locate the fixture. When the wedges of the upper electrode descend they clamp the work held in the lower electrode. An air-operated clamp, the same form as the grille, presses the work in place and clamps the jig on the table. This compresses springs which support the wheels and permits pins at each end of the jig to engage locating holes. Two self-equalizing welding tips are mounted on each gun Welding current passes from the transformer in the machine base through two tips of one gun, through the mobile jig and back through the two tips of a second gun to complete four spot welds at one time. Twenty spots in all are required for each grille half. When the welding cycle has been completed, the jig is automatically released.



Michigan Tool Offers Hob Checking Fixture

A fixture for routine checking of hobs after sharpening has been designed by Michigan Tool Co , 7171 E McNichols Rd , Detroit, Mich. This fix-



ture will check hobs for radial sharpening, spacing of flutes and runout of hubs. It can also be used for checking single form relieved cutters or form gashing cutters for sharpening and spacing

Fixture is universal in character and has a maximum capacity of 12 in. diameter and 15 in between centers. Dial indicator can be moved in both horizontal and vertical planes, while the head carrying the indicator can be moved parallel to the centers for checking at either end of a long hob. Vertical indicator movement is accomplished by a micrometer barrel having a graduated dial to permit exact setting.

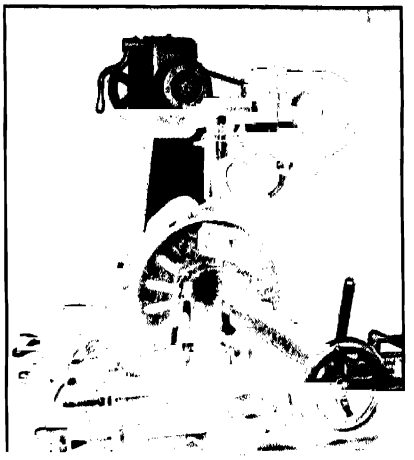
For checking the runout on diameters, a bracket is provided on the side of the slide. A standard indicator for checking runout may be mounted on this bracket. Inaccuracies

in readings due to play at the centers are avoided by mounting the index plate on the arbor, permitting the centers to be solid The pawl which engages the index plate is mounted on the headstock of the fixture in a position to prevent it from loosening in its seat

Over-all dimensions of the fixture are 38x25x20 in Shipping weight is 450 lb Furnished with each fixture are an index plate, a 1¼x6 in arbor, and one indicator

Berkeley Machine Tool Drive Uses 4-Speed Transmission

Either a 3- or 4-speed selective sliding gear transmission can be furnished on the motorized machine tool drives developed by Berkley Equip-



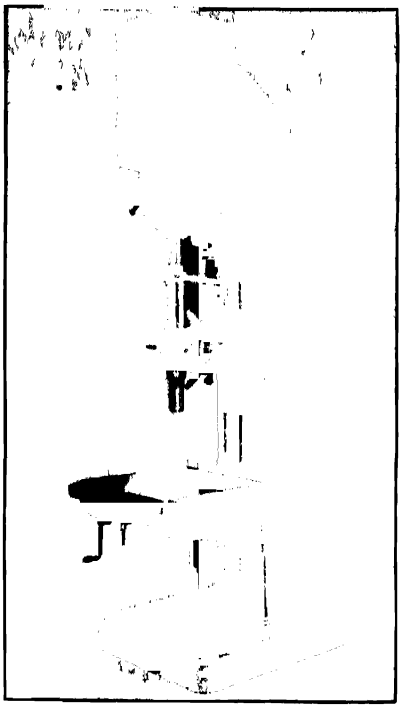
ment Co, Corry, Pa These drives, mounted on specially designed custom-built welded steel brackets, can be easily applied to all types of tools

Transmission gears are of large proportion, made of heat-treated alloy steel Gears are moved in and out of mesh by yokes sliding on shafts at the top of the transmission and operated by a single lever Highest speed is through direct drive An interlock makes it impossible to mesh more than one pair of gears at a time The unit operates in a steel housing so that the gears run in an oil bath Simple means for belt adjustment is provided

Motor-Spindle Drill Developed by Buffalo

Buffalo Forge Co, Buffalo, N Y has made available two sizes of a new type of motor-spindle drill The No 2, powered with a 2-hp motor, can be furnished with either 8 or 13 in overhang, while the No 3, powered with a 3-hp motor, is built with 13 in overhang only Pedestal models are available having from one to six spindles

Machines can be furnished with or without back gears, with or without



power feed, and with or without motor reverse for tapping A drum type pole changing switch is provided for starting stopping and changing motor speeds Overload protection is obtained by a thermal overload device mounted on the motor Controls and wiring are inclosed

Riehle Testing Machine Has 100-Ton Capacity

A 100-ton materials testing machine has been built by Riehle Testing Machine Div American Machine & Metals Inc, East Moline Ill Claimed to be among the world's most accur-

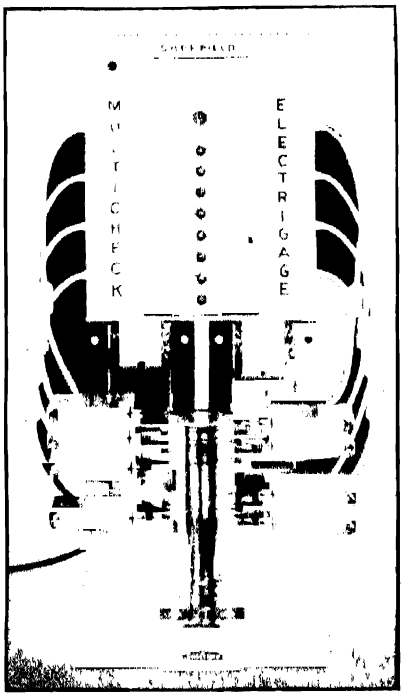


ate machines of this type, it is capable of indicating values with an error of 0 06 of 1 per cent while exerting test pressures of 700,000 lb Machine measures 34 ft in height, 21 ft in width, and 24½ ft from front to back Transverse table is over 8 ft wide

Sheffield "Multicheck" Gage Permits Faster Inspection

The "Multicheck Electrigage" is a precision instrument for the simultaneous checking of several critical dimensions developed by Sheffield Gage Corp, Dayton, Ohio It is particularly adaptable for the inspection of timing fuse elements, shell bodies, cartridge cases and other munitions items

Measurements of length diameter and depth are flashed simultaneously on a control board by colored signal lights as the part being inspected is placed in gaging position An individual gaging head is incorporated for each dimension to be checked, each head actuating a signal light



When one of these signal lights shows amber in the gaging operation, the diameter is within tolerance. When the light shows red it indicates the diameter is undersize and when green, oversize

In addition to the individual signal lights, this gage has a master signal light which integrates all measurements When the master signal shows white, all dimensions are within tolerance When it shows red, the individual signal lights are observed to determine which dimension is incorrect and whether it is plus or minus. Lenses are usually placed in a

straight line above or alongside each other. A plan of the work part indicates each dimension with its own light.

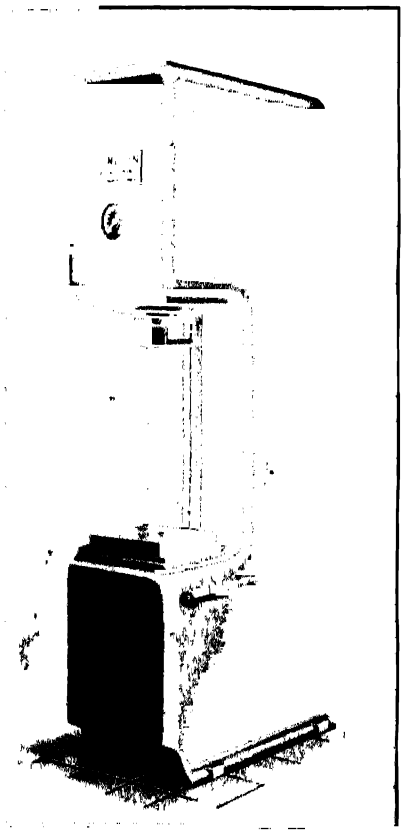
A patented reed mechanism is the heart of each "Electrigage" head. The mechanism employs no gears, knife edges or levers There are no rubbing contacts, so it is not subject to frictional wear. It is so designed that it can be applied in innumerable combinations. Being a self-contained unit, if at any time the work upon which it is used changes, it can be dismounted and applied elsewhere

It is claimed that one operator can check seven dimensions on a 75-mm shell at the rate of 600 per hr. without eye strain. These instruments can be used on parts as large as desired, and are also being used on minute parts—such as a pinion less than ⅛ in. long and less than $\frac{3}{32}$ in. in diameter.

Denison Hydraulic Press Offered in Four Sizes

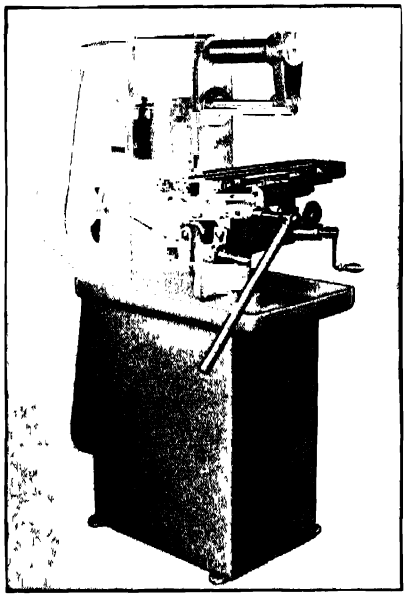
Denison Engineering Co, 236 N Water St., Columbus, Ohio, has made available the Type DLAC2 general purpose hydraulic press in sizes of 5, 15, 25 and 50 tons capacity Adaptable for assembling, straightening and general production pressing, this machine is completely self-contained and requires a minimum of floor space.

Control valve with its operating mechanisms, motor and pump are located in the center section. Ram and cylinder assembly is in the upper part of the C frame, and the oil reservoir is in the base When the control lever is depressed the ram descends until it either contacts the work or reaches the limit of its downstroke. On contacting the work the press continues to exert tonnage until the controls are released. When the ram returns to the limit of the upstroke it stops, the pressure is released and the pump and motor run idle Both up and down strokes and pressure are easily adjustable. Presses can be furnished for either manual or electrical operation. Frame is of electric welded construction with rounded corners and convenient toespace for operator. A constant volume vane type pump is used.



Improved Milling Machine Has Greater Speed Range

Miller & Crowningshield, Greenfield, Mass., has improved its hand and power feed milling machine by altering the V-belt drive to give a greater



range of speed and to provide greater convenience in changing belts. Former base has also been replaced by one of all-steel construction

A ½-hp motor with a reversing switch is standard equipment, but a ¾- or 1-hp. motor is recommended for high-speed work. Motor and jackshaft each have a 3-step V pulley. Four interchangeable single V pulleys provide twelve speeds ranging from 180 to 3,200 r.p.m.

Lightweight Sound Meter Handles 24–120 Decibel Range

A portable sound-level meter, lighter and more compact than any previous instrument of its kind, has been developed by General Electric Co., Schenectady, N. Y. It weighs only 19 lb. but has a range of 24 to 120 decibels. It may be used conveniently for almost any kind of noise study, including airplane engines, motors, fans, generators, turbines, pumps, bearings, gears, cylinders and other machinery parts.

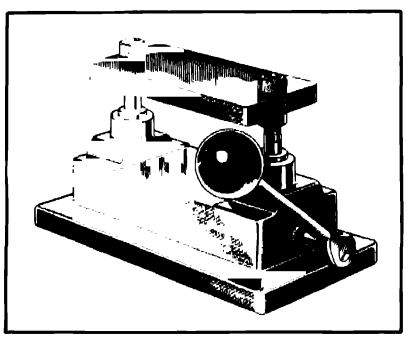
Essential parts of the device are a microphone, an amplifier and an indicating instrument An arm extension protects the microphone from sound reflected from the case. The amplifier consists of five stages. Bat-



tery-operated tubes are mounted on a shock-proof base, thus reducing errors due to vibration. Complete instrument, including microphone, mounting arm, calibrating unit and batteries, is contained in a carrying case 12¾ in long, 7¼ in wide and 9¼ in high

Universal Drill Vise Features Simplicity

Mohr Line-Saw Co, 126 N. Union Ave., Chicago, Ill, is offering a universal drill vise said to be unusually simple in manipulation Claimed to effect remarkable savings in time and in tooling cost, this device is adaptable for a wide variety of drilling operations A slight pull on a ball-handled lever locks the work securely in place; work is released by



moving the lever in the opposite direction. Screws, bolt, and nuts requiring tightening or loosening are eliminated.

Vise is also practical for use as a standard drilling jig. With different drill bushing plates and adaptors, it may be used for a wide variety of drilling operations. Tool is 9 in. long

In vertical Milling Machines also, rigidity originates in the column — the backbone of the machine—and determines the productive capacity of the machine more than any one other factor.

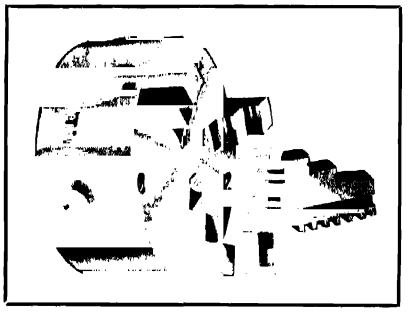
Note how carefully the column of a Milwaukee Vertical Milling Machine has been engineered for the proper distribution of metal — an inside horizontal wall divides it into a double box section, the cross mounting of the motor permits a solid rear wall, which, together with the solid front face, assures an unusually rigid structure.

KEARNEY & TRECKER CORPORATION • Milwaukee, Wis. U. S. A.



MILWAUKEE MILLING MACHINES

and 5 in wide over base. It weighs 14½ lb A 6½x3-in bushing plate is furnished as standard equipment, and extra plates to meet an almost unlimited variety of requirements are available The 40 1 compression ratio is maintained Leader pins run in hardened and ground bushings.



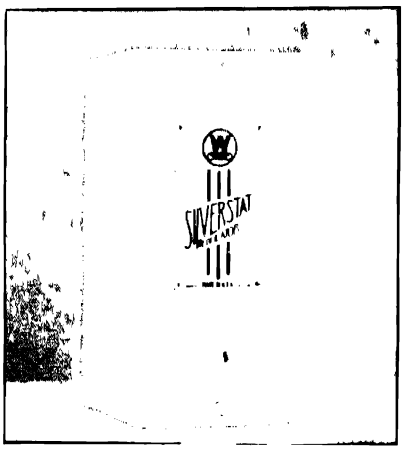
Westcott Lathe Chucks For General Purpose Use

Westcott Chuck Co, 324 E Walnut St, Oneida, N Y, has introduced a line of light-weight "Oneida" universal lathe chucks for general purpose use Mounted on the spindle by an adapter, these chucks are made with a semi-steel body and are equipped with two sets of jaws Jaws, scrolls and pinions are heat-treated for longer life and greater accuracy All parts are precision made with large bearing surfaces to provide firm grip and durability Sizes available run from 4 to 12 in, with weights ranging from 9 to 82 lb

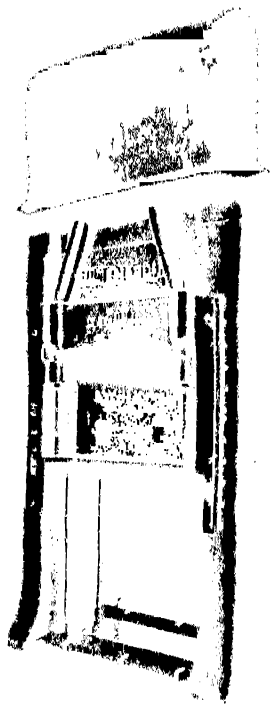
Westinghouse Voltage Regulator Controls Smaller Generators

For automatic voltage control of small a c and d c generators, a quick-acting rheostat type regulator has been developed by Westinghouse Electric & Mfg Co, East Pittsburgh, Pa Known as the "Silverstat Junior," it is available in d c ratings up to 25 kw and a c ratings up to 44 kva

Inexpensive, simple, and dependable, this regulator performs continuously the same operation as obtained by hand manipulation of the field rheostat, keeping generator output voltage within 3 per cent of normal Non-oxidizing silver buttons assure clean contacts and minimum wear There are no parts requiring readjustment or replacement at frequent intervals



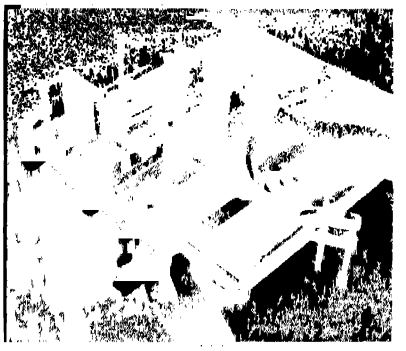
Toledo Double Action Toggle Press Provides Extra Long Die Adjustment



An exceptionally long adjustment for high and low dies is provided on the No 2-E-10-86 straight sided double action toggle drawing press developed by Toledo Machine & Tool Div of E W Bliss Co, 1420 Hastings St Toledo, Ohio This press is of four piece steel tie-rod construction with shrunk-in tie rods Castings are of high-alloy semi-steel with high strength and with increased surface hardness

All gearing, eccentrics and other mechanisms are inclosed in the press crown. Covers are easily removable A cascade filtered oil system is employed. Lower motion of the press is independently driven and electrically synchronized. Other features include triple gearing, V-belt drive, hydraulic friction clutch with disk brake, pushbutton control, hydraulically operated brake for stopping the flywheel after the power has been turned off, and a slide which is said to be completely counterbalanced by air cylinders

Specifications: bed area, 62x86 in; capacity of plunger slide, 650 tons; distance from bed to slide with stroke down and adjustment up, 75 in.

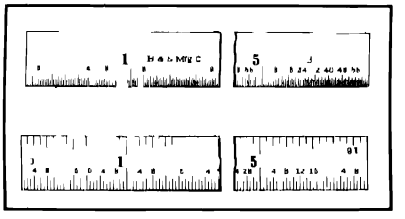


Low Cost Surface Plates Introduced by Delta

To meet the demands for reliable low-cost surface plates, Delta Mfg Co, 620 E Vienna Ave, Milwaukee, Wis has developed 15 x 8 and 16 x 22 in machine finished surface plates These 3-in plates provide a true surface to start with, a massive design and properly ribbed casting to insure the surface remaining true, ledges at the edges for clamping, and edges that are square with each other and with the face These plates may be made into precision plates by scraping to a master plate or to one another

B&S Flexible Steel Rule Has Three Scales

Brown & Sharpe Mfg Co Providence R I, has introduced a new 6-in flexible steel rule for machinists Identified as the No 306C this rule is graduated in 16ths and 32nds of an inch on one side and in 64ths



of an inch on the other Markings are such that the rule need not be turned end for end when changing from one scale to another The rule is approximately ½ in wide and 1/64 in thick

Precision Index Centers Offered by Hardinge Bros.

Hardinge Bros, Inc, Elmira, N. Y., has developed new index centers for its precision toolroom milling machine which incorporate sturdy construction, large collet capacity and features to speed up production in milling precision parts

Compact box-like construction reduces over-all height and provides a sturdy base for spindle section. Spindle is mounted in super-precision preloaded ball bearings. Spindle sec-

Announced Sept. 3rd—Industry ... Thousands ... the Year!

NEW...CARBOLOY STANDARD TOOLS FOR "UNIVERSAL" SHOP USE ON 80% OF ALL TURNING, BORING, FACING JOBS!

Detroit, Sept. 3.—Mass production on a standardized line of Carboloy tools, designed to cover 80 per cent of all applications for cemented carbide tools, was announced by Carboloy Company, Inc., today.

The introduction of this simplified line of tools—comprising but five styles in three different grades—together with the economies resulting from mass production, has made it possible to price these complete tools well below comparable tools in the past, a typical new 'standard' tool, Style 4, now priced at only $1.85, comparing with tools previously costing $5.84 in lots of one. In quantities of 50 or more this typical tool now costs only $.90.

The program that has made this unprecedented step possible has been under development for the past three years. In the period from 1929 to 1937 prices of Carboloy cemented carbide



Style No. 1—Standard Tool
Available in 9 sizes

were progressively reduced four times as the result of economies resulting from increased consumption. About that time it became apparent that to widen the scope of useability of Carboloy tools required a complete revision of the principles under which such tools had been produced and sold up to then. What was needed was mass production of complete carbide tools on a scale never before attempted in this country.

Since 1937 extensive research work in the laboratory and in the field has been devoted to determining the fewest number of 'grades' of Carboloy and the simplest line of tools that would meet the vast majority of all carbide tool applications.

New $1,000,000 Plant Part of Program

Early in 1938 this development work had progressed to a point where Carboloy Company could proceed



Style No. 4—Standard Tool
Available in 9 sizes, left and right hand

with its next step—the expenditure of a million dollars on a new plant and equipment to expand and concentrate manufacturing activities. This plant, completed in the spring of 1939, was designed with a production capacity of ten times the amount of cemented carbide then consumed by industry, with provisions for expanding metal production to many times that amount.

Since that time, research and field experimental work has resulted in reducing the number of grades of Carboloy required for the vast majority of applications to only three —one new grade for steel cutting, and two for cast iron. Further, it was found that five styles of tools in each of these grades would cover 80 to 90 per cent of all turning, boring and facing applications.

The basic design of these tools is



Style No. 13—Standard Tool
Available in 5 sizes, left and right hand

such that several hundred variations can be rapidly ground in the tools by the user to meet special requirements. With the fast, simple grinding procedure developed during the past five years and now widely used by industry, such tool changes can be rapidly and economically accomplished. This rapid grinding procedure, plus the fact that the price of these new standard tools is comparable to that of many ordinary tools, brings to the field of Carboloy tool use a flexibility that permits broad 'universal' use of these tools within the average shop on short job-lot work as well as production runs.

The new standardized tools are carried in stock, ready for shipment, completely ground and ready for use. An extremely valuable feature is the incorporation of a ground-in chip breaker on all standard tools designed for the machining of steel, at no additional charge.

The new program, according to the announcement, is anticipated to produce a wider scale use of carbide tools, thereby reducing the cost of produc- -f basic cemented carbides to that in spite of higher ost.

Carboloy Announces 6th Price R

Since the year when Carboloy tools were first introduced it has been [illegible] Carboloy Co

For a number [illegible] have realized tha [illegible] reducing the [illegible] le[illegible]

✓ LOW PRICED! (Check against any other cutting tools)
✓ SIMPLIFIED ORDERING!
✓ SIMPLIFIED TOOL STOCKS!
✓ IMMEDIATE SHIPMENT!
✓ YOU GET THEM ALL GROUND READY FOR USE! (Steel cutting tools furnished with ground-in chip breaker)

Example of chip breaker ground in steel cutting tools.

Have You the Facts?

WRITE FOR CATALOG GT-125

CARBOLOY COMPANY, INC.

11149 E. 8 MILE RD., DETROIT, MICH.

Chicago • Cleveland • Newark • Pittsburgh • Philadelphia • Worcester, Mass. • Los Angeles

Ca[illegible] Distributors Canadian General Electric Company, Ltd., Toronto

CARBOLOY

[illegible] OFFICE

NOVEMBER 13, 1940

tion swings through an arc of 220 deg. and is graduated in degrees for settings from 10 deg below horizontal to 20 deg. beyond vertical A vernier in minutes is incorporated for fine settings Precision, hardened spiral bevel gears and a nitrided spiral bevel pinion provide a 4 1 ratio between spindle and index plate crank Index plate mounting is independent of the gearing with the spindle and crank, being engaged between the two by a clamp on the index plate outer periphery

Anti-friction bearings are provided



for all gears and shafts. Spindle section has large swivel bearings and positive locks to secure angular settings Index head may be mounted either crosswise or parallel with the machine table It swings work having a 7 in diameter Index head and tailstock have a combined length of 14¾ in

"Quicklag" Breaker Combines Thermal and Magnetic Action

Designed primarily for protecting lighting and motor circuits, the "Quicklag" circuit breaker developed by Westinghouse Electric & Mfg Co, East Pittsburgh, Pa, combines for the first time in a single unit a cooperative magnetic and a thermal trip It is available in ratings of 15 to 35 amp, single pole only, 250 volts a c and 125 volts d c

Combination of bi-metal thermal and magnetic trip action gives the device the advantage of instantaneous trip on short circuits combined with time delay for momentary overload Breaker size is smaller per watts capacity than that of any similar unit before it There are no live parts exposed to accidental contact Calibration is permanent and is sealed against tampering Operating mechanism gives a quick make and break, and arcs resulting from heavy current interruptions are quickly snuffed out by the "De-Ion" grid assembly To facilitate connections, solderless terminals are used Operation is indicated by the handle position Current ratings are marked on the operating handle, which is trip-free



"Electrifugal" Pump Made Available by Allis-Chalmers

The "Electrifugal" pump offered by Allis-Chalmers Mfg Co, Milwaukee, Wis, is an all-in-one centrifugal pump especially designed as a complete unit on one shaft and in one housing Instead of using standard motors having special end housings and shaft extensions, this pump has a special motor with a one-piece



cast-iron motor yoke and pump bracket Feet are cast integral with the housing and bracket, and extend under the entire unit instead of under the motor only

Special motor design, with copper-bearing steel cover, meets N E M A specifications for splash-proof motors Totally enclosed, fan-cooled motors and explosion-proof motors are also available in the "Electrifugal" type In splash-proof construction the pump is available in sizes from 1 to 10 hp at 3,500 r p m, and from ¾ to 7½ hp at 1,750 r p m for heads up to 160 ft

For normal service the pump is built with cast-iron casing, bronze fitted It can, however, be made of all iron, all bronze, all stainless steel, or other special metals to suit any application In the chemical industry the sheet metal motor cover can be made of stainless steel to provide the longest possible complete unit life on any particular installation.

"FerroFilter" Oil Cleaner Uses Permanent Magnets

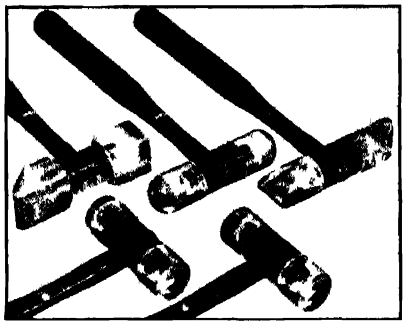
The "FerroFilter" oil cleaner developed by S G Frantz Co, 161 Grand St., New York, N Y, for lubricating and hydraulic oil systems uses permanent magnets to extract minute iron particles that would pass through ordinary filters. The cleaner, which permits an unobstructed flow of lubricant, consists essentially of a case in which are mounted two "Nipermag" magnets. Between these magnets and within a bronze tube which directs



the oil flow are grids made of a high-permeability alloy Iron particles flowing into the filter are held either on the magnets themselves or on the large magnetized grid area. Cleaning is accomplished by disassembling and washing in kerosene, an operation which is greatly facilitated by the fact that the grids become non-magnetic when removed

Stanley Soft Face Hammers Made With Various Tips

An extensive line of soft face hammers has been developed by Stanley Tools, New Britain, Conn, for use on assembly jobs requiring a hammer

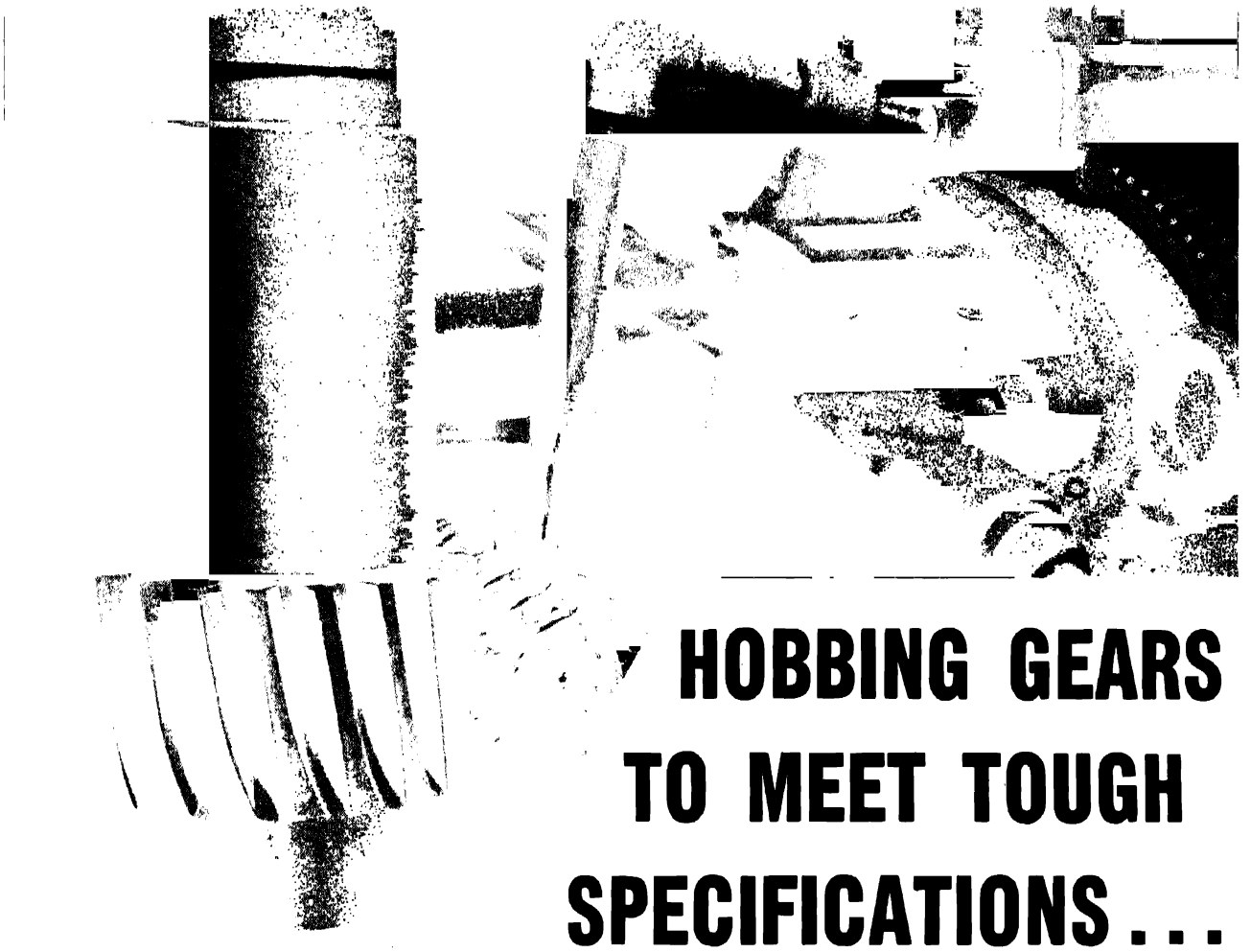


which will not mar finely finished surfaces or delicate machine parts Tips are of "Stanloid," a tough, resilient, non-metallic substance Hickory handles are securely wedged in a steel center body.

Various shaped tips—regular face, ball pein, cross pein, straight pein, offset pein, square tip, and regular face with brass insert—make these hammers suited for mechanics, machinists, sheet metal workers, motor builders, service men, and for workers in defense industries All tips are renewable

Lyon Die Handling Truck Maneuvers in Small Space

Lyon Iron Works, 550 Madison St, Greene, N. Y, has designed a die handling truck on which all four wheels can be steered for greater maneuverability in tight places. Turning of the wheels is controlled by a bar to which a removable handle is attached. This handle is arranged for hand-drawing or towing back of a power truck, and may be drawn



HOBBING GEARS TO MEET TOUGH SPECIFICATIONS . . .

HOBBING gears of extreme hardness (325—350 Brinell) as used in oil well pumping reducers—for particularly arduous duty—was the problem of a Chicago manufacturer. In cutting and maintaining this unusual hardness and maintaining high accuracy, Cities Service oils were used as the cutting lubricant.

No doubt you have one or two like problems in your shop. Why not find out what our lubrication engineers can do for you in your own shop with the right metal cutting lubricant? Just write us to have a lubrication engineer call.

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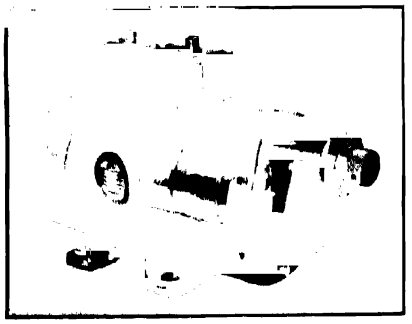


from either end The truck is arranged so that wheels on either end may be locked in position for towing at the opposite end One wheel on each end is furnished with a brake

Capacity of the truck is 8,000 lb Platform is 24 in wide, 60 in long and 30 in high Wheelbase is 60 in , over-all length is 72 in , tread is 31 in , and over-all width is 34 in Trucks can be furnished with a hydraulic elevating table

Walker-Turner Develops Two-Speed Geared Motor

Shock-proof geared motors built by Walker-Turner Co , Plainfield N J have been made available with a double winding which, together with an interlocking switch, provides two speeds instantly changeable This motor, the two speeds of which are



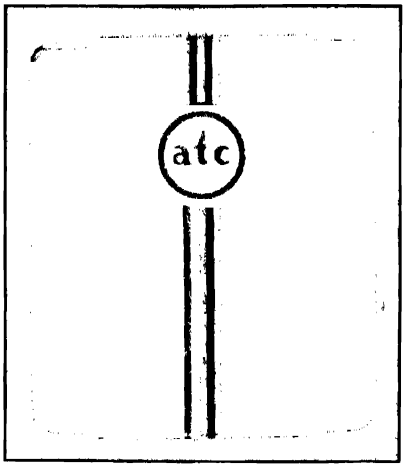
pushbutton controlled, is applicable to many types of equipment requiring instantaneous speed change

Available in various speeds from 700 to 8,000 r p m and in sizes from ¼ to 3 hp for polyphase circuits only, this motor has been thoroughly tested in service as standard equipment on flexible shaft machines

Close Temperature Control Achieved by A.T.C. Relay

The A.T.C. balancer relay developed by Automatic Temperature Control Co., 34 E. Logan St., Philadelphia, Pa , is suitable for application on the proportioning type of fuel control systems for close maintenance of furnace temperature It can be used on either batch or continuous furnaces, and besides maintaining a straight pyrometer chart line, it is claimed virtually to eliminate overshooting on coming up to heat It is used with a pyrometer having a slide wire and high and low contacts with a no-contact neutral Fuel regulator may be either a valve operator for oil or gas fired furnaces or an input controller for electric furnaces

Among the features of the relay are



automatic load compensation, full anticipation when coming up to heat, adjustable throttling range and adjustable rate of reset Case in which it is housed is suitable for either flush or surface mounting

"Veeco" Drafting Machine Uses Combination Indexing

An outstanding feature of the "Veeco" drafting machine offered by V & E Engineering Co , 758 S Fair Oaks, Pasadena, Calif , is its combination indexing Manually controlled indexing for infrequent



changes in angular position is operated by a thumb-piece conveniently located in the handle. For automatic indexing, protractor arm can be set and automatically held at any predetermined angle. Elbow brake is readily adjusted by a single thumb screw to prevent sliding on inclined table Head can be raised high to facilitate positioning the drawing paper Zero reading can readily be set for a base line of any orientation Head is supported by a large, centrally positioned plastic skid button Engine divided circle is 4¾ in in diameter.

Truflo Penthouse Fans Handle Gas, Fumes, Dust

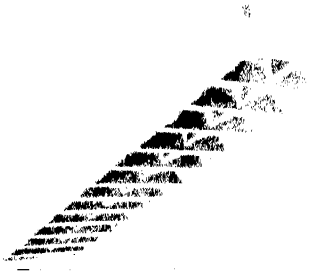
Truflo Fan Co , 557 Main St , Harmony, Pa , has developed an extensive line of penthouse fans for venting obnoxious gases, fumes and dusts Penthouses are of sturdy steel construction, and are available in a complete range of sizes for housing standard Truflo wall fans of 12 to 48 in diameter Sheet steel walls and shutters are mounted on heavy angle iron frames Shutters open and close automatically, and the

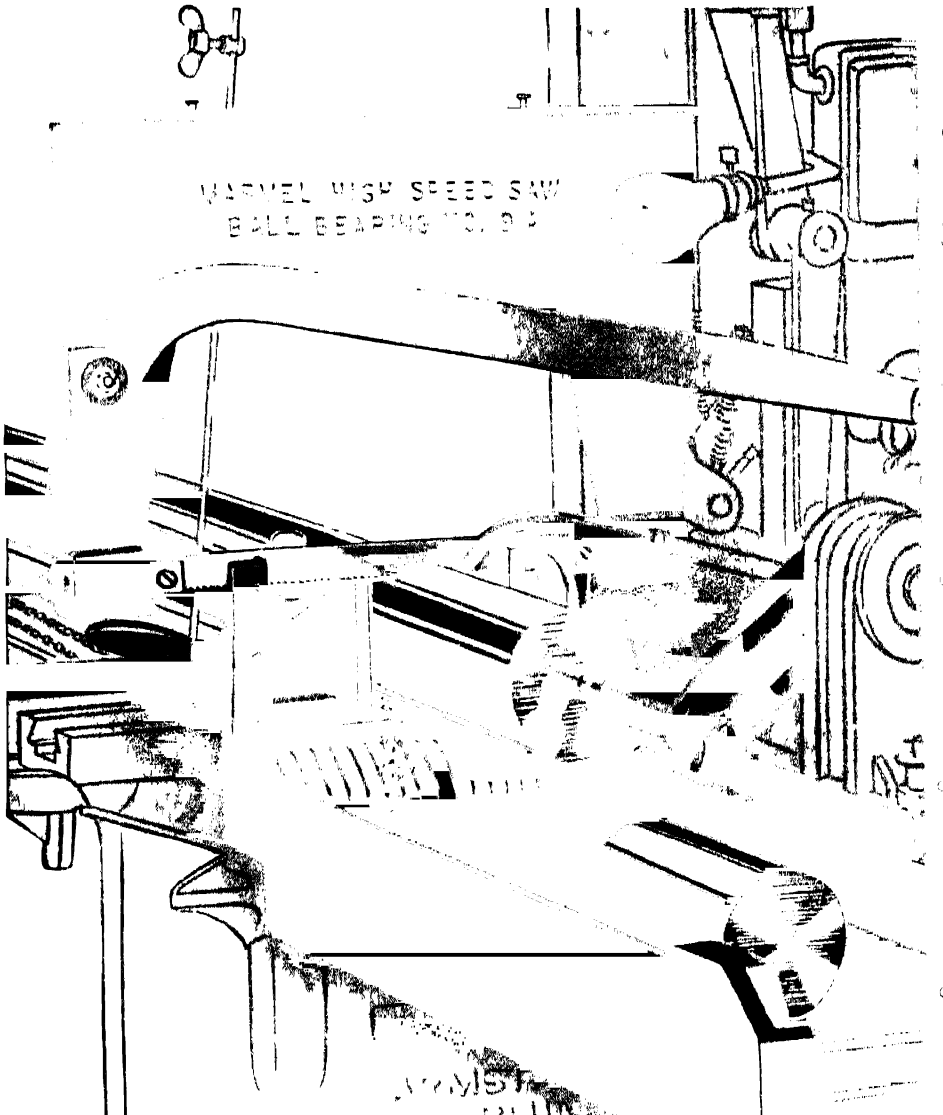


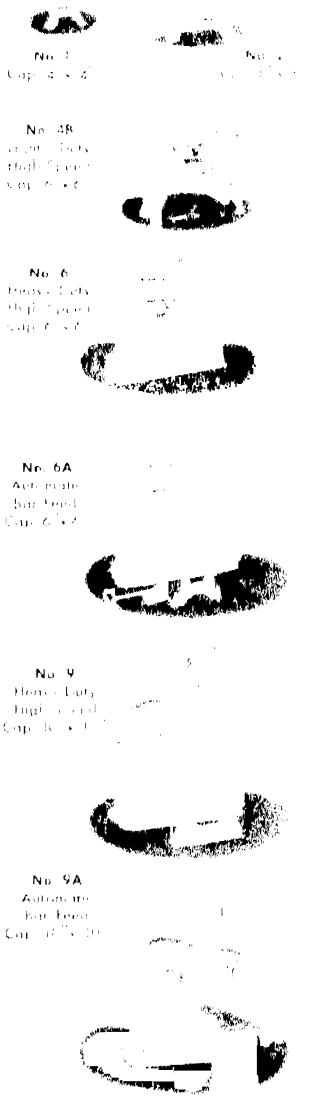
penthouses are designed to afford greatest possible protection against inclement weather conditions Penthouse is placed directly over roof opening and fan exhausts air through opening, or from several floors below by using a duct con-

Fluorescent Unit Louvers Help Kill Excess Glare

Better control of glare from fluorescent units is achieved by lamp-shielding louvers made available for the "Stream-liter" fluorescent fixtures made by Benjamin Electric Mfg Co , Des Plaines, Ill These louvers in-







You can cut-off *faster* with a MARVEL SAW

If you want high speed, quantity production of pieces or lengths cut from bar stock, you can get it best with a MARVEL Production Saw. These heavy-duty, all-ball-bearing sawing machines, equipped with an automatic bar push-up require no more attention than an automatic screw machine, yet cut-off more pieces per hour, floor-to-floor, than any other cutting-off method.

They set new standards for fast cutting-off with accuracy and low cost per piece, whether cutting off thin slices (as for gear blanks) or long lengths (like rifle barrels).

These high speed "automatic" saws come in two sizes The MARVEL No. 6A, Capacity 6"x6", and the MARVEL No. 9A, Capacity 10"x10". With the other MARVEL Saws, they comprise the most complete line of sawing machines built—a line that provides exactly suited saws for every purpose.

MARVEL SAWS

ARMSTRONG-BLUM MFG. CO. "The Hack Saw People" 8748 Bloomingdale Ave., Chicago, U.S.A.

Eastern Sales Office: 199 Lafayette St. New York

crease the shielding angle to approximately 23 deg in all directions. Such increased shielding hides the lamps when viewed from the side or end of the reflector in all normal angles of vision. Louvers are of steel, finished with a special high reflection factor white enamel Parts are welded into a rigid assembly at each interlocking point, and the entire unit is welded to a rectangular frame rail which fits into the bead of the reflectors It is held in position by two spring clamps on each side of the rail

"Mu-Switch" Has Roller Actuator and Spring Leaf

Comprising a phosphor bronze leaf spring riveted at one end to the switch cover and having at its free end a U-bracket which holds a ⅜ x ¼ in plastic roller, this new style actuator adapts to high-speed cam operations the "Mu-Switch" made by Mu-Switch Corp, Canton, Mass Self-lubricated roller permits

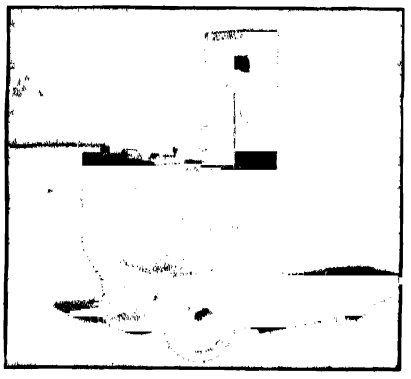


close bearing tolerances, with resulting accuracy of action, and gives quiet operation and freedom from wear Type W actuator gives protection against overtravel, and is claimed to have long life under conditions of high-speed, high-temperature service

Baker "Hy-Lift" Truck Operates in Narrow Aisle

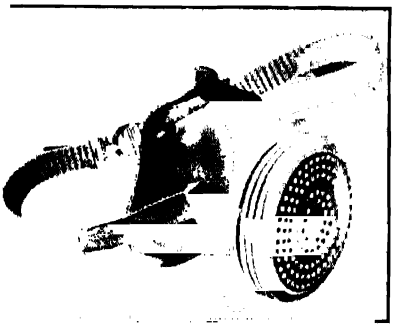
The type H-2 Series F "Hy-Lift" 4,000-lb. truck has been developed by Baker Industrial Truck Div of Baker-Raulang Co, Cleveland, Ohio, especially for operation in narrow aisles and congested areas

Lifting is accomplished by a hydraulic system incorporating a gear pump driven by its own motor and connected to the lifting cylinder through suitable control and release valves Control valves are of the metering type, permitting absolute speed control at all times. Standard simple lift is 60 in. Standard telescoping lift is 119 in All controls and hoists are grouped in a convenient control panel



Willson "Bantam" Respirator Features Light Weight

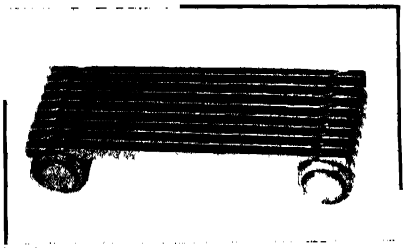
Claimed to be the lightest weight throw-away filter-type respirator yet to receive the U S Bureau of Mines



approval, the "Bantam" respirator offered by Willson Products, Inc, 251 Thorn St, Reading, Pa is said to be so light and so easy to breathe through that it can be worn for long periods without causing any noticeable discomfort or slowing down of the worker Rugged assembly includes an all-rubber face plate which cannot be crushed out of shape

Wedge Wire Sections Now Made in U.S.A.

Wedge wire—wedge-shaped or undercut bars formed integral with solid heavy loops spaced at definite intervals—formerly available only from Europe, is being made in the United

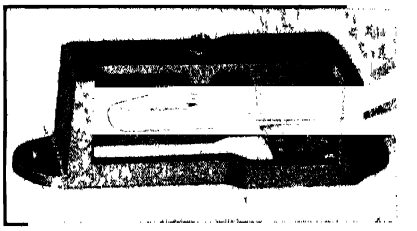


States by Wedge Wire Corp, 5200 Harvard Ave, Cleveland, Ohio "Loop-bar" strands are fixed in grid form by cross rods riveted or bolted in place Such construction assures dependable accuracy, strength and uniformity for high-capacity sieve and screen application Standard apertures are 0 01, 0 02, 0 03 and 0 04 in Screens can be made of practically any metal

Strip Type Thermostat Mounts on Flat Surface

Claimed to be ideal for controlling temperatures of electrically heated flat surfaces, the "UL Strip" type thermostat is offered by George Ulanet Co., 89 Kinney St, Newark, N J A sturdily built element with large silver contacts and readily accessible adjustment screw is mounted in a cast aluminum housing which conceals the terminals

Capable of handling 1,500 watts at



115 or 230 volts a c, units are available with maximum operating temperatures of 300 450 and 700 F Either normally closed or normally open contacts can be provided Contacts operate with a 5 deg temperature differential Device can be adapted to control air temperatures by perforating the housing Dimensions of the unit are 4½ in long 1½ in wide and 1¼ in high

G. E. "Wirometer" Helps In Solving Wiring Problems

A pocket-size wire calculator, called the "Wirometer" for use in computing wiring problems in accordance with the 1940 National Electrical Code, has been devised by General Electric Co Bridgeport, Conn Information which may be obtained quickly includes, conduit fill of all approved types of building wires, including wires of different sizes in one



conduit, corrections in current-carrying capacity for ambient temperatures over 30 deg C, and voltage drop for eight distribution systems The device is 8 in long and 2⅛ in wide, and is made up of two sliding celluloid covers and six interchangeable cardboard slides

Fast Brass Plating Process Made Available by du Pont

A brass plating process two to four times as fast as present processes has been developed by the Electroplating Div of E I du Pont de Nemours & Co, Wilmington, Del, to provide a plating method which will

yield smooth, bright deposits of controllable thicknesses at a more rapid rate of deposition It also makes possible heavy brass deposits 0 001 in or more in thickness, in a reasonable time.

Use is made of prepared high-speed brass salts to provide a simple, quick preparation of a new bath, which will plate immediately, eliminating the "breaking in" period necessary before satisfactory results are obtained The process operates without polarization at high anode current densities, giving proper composition and color of plate and the purity necessary to maintain the efficient operation of the bath Additional agents prevent pitting, improve lustre and prevent objectionable fumes

The relatively low temperature of operation, 105-125 F, assures ease of control and economical processing. A uniform bright yellow color may be obtained over a wide range of current densities Uniform color over recessed objects is possible Characteristics of the deposit may be constantly maintained by definite chemical control

Fluorescent Lighting Units Developed by Miller

Two industrial fluorescent lighting units have been developed by The Miller Co, Meriden, Conn First is the "Masterlite" for general and localized industrial illumination This unit is designed to give better general overhead illumination of production areas than has heretofore been available It conforms to R L M Standards specifications for a 48-in twin 40-watt unit

Second development is the "50 Footcandler", said to be the first 50 footcandle R.L M continuous fluorescent lighting unit for general illumination It is available in either single or double length wiring channels for two or three 40-watt lamps

Westinghouse Magnetic Starter Controls Squirrel Cage Motors

A line of magnetic starters for use with multi-speed squirrel cage motors of 220–660 volts, 1–100 hp, has been announced by Westinghouse Electric & Mfg. Co, East Pittsburgh, Pa. These units start the motor across the line at any speed Different speeds are obtained by changing motor connections to change its number of poles.

Starters are available for the following types of multi-speed motors in 2, 3, or 4 speed types: constant horsepower, constant torque, variable torque, single winding and double winding. Features include pushbutton speed selection, accurate overload protection, low voltage protection, "De-Ion" arc quenchers, and front-of-board wiring with accessible terminals. Optional features include selective speed control, compelled

(advertisement)

Modern Flame Cutting Methods Save Time and Money

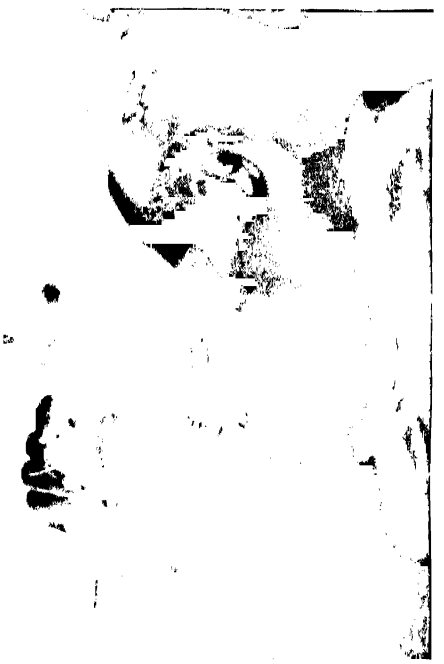
Thousands of American manufacturers are saving considerable time, trouble and money by taking advantage of the complete flame-cutting service offered by the ten Ryerson Steel-Service plants.

Modern burning equipment manned by specially-trained operators, and large, complete stocks of Ryerson Certified Steels make possible speedy and accurate cutting to exact specifications Any shape can be burned from standard O H high carbon or alloy steel plates and billets ½" to 15" thick Inside cuts are easily made, so there is no limit to the intricacy of shape that may be secured

As cut edges are accurate and clean, little, if any, machining is necessary. Parts can be cut singly or in quantities, automatic equipment assuring uniformity on duplicate pieces

Ryerson engineers will be glad to help you on any special problems, suggest possible savings, and submit estimate of cost Send a blue print or sketch of any application you may have in mind to the Ryerson plant nearest you (See advertisement below)

Buy Steel with LABORATORY CERTAINTY -at Ryerson



Every shipment of alloy steel is accompanied by accurate data based on laboratory tests, covering exact chemical and physical properties, grain size, cleanliness rating and hardening characteristics. With the Ryerson data sheet before you, you know what steel you are getting, you secure best heat treatment results and you save time because you do not have to test.

Ryerson stocks also include a wide range of stainless, heat-and corrosion-resisting steels, sheets and tubing—all closely controlled as to chemical content. Many highly specialized steel requirements can be supplied on a moment's notice!

Ryerson Steel-Service is geared particularly to the needs of defense industries. All Ryerson products are painstakingly selected for their uniform high quality. They are carefully warehoused, accurately cut to your specifications, and shipped on the dot from ten convenient stocks of over 10,000 sizes, kinds and shapes.

Submit your next steel problem to the nearest Ryerson plant. If you haven't the 1940-41 Ryerson stock list and data book, send for it today. It will quickly become your guide to quality steel and fast steel service.

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T Ryerson & Son Inc, Chicago, Milwaukee, St Louis, Cincinnati, Detroit, Cleveland, Buffalo Boston, Philadelphia, Jersey City

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20 HOURS SAVED HERE



Riveting Anvil Part for a large gun manufacturer, made by Connecticut Tool & Engineering Co., Bridgeport, Conn. It took a little less than 4 hours, including set-up time, to saw out the four anvils from machine steel. This meant a saving of 5 hours on each piece, as compared with milling.

FASTEST METAL CUTTING MACHINE

The DoAll offers industry the fastest method of cutting internal and external shapes from any metal up to 10" thick. Replaces shaping, milling, and lathe work, and effects unprecedented savings of time, labor and material.

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slow speed start, and automatic sequence acceleration and deceleration. All sizes are available in standard or dust-tight sheet steel enclosures.

Hammond Polishing Lathe Now Has Variable Speed

The "Rite-Speed" overhanging spindle polishing lathe (*AM*—Vol. 84, p. 776) made by Hammond Machinery Builders, Inc., 1618 Douglas Ave., Kalamazoo, Mich., has been improved by the addition of a variable speed transmission. With this device, available on the Model VRO machine, spindle speeds from 1,500 to 3,000 r.p.m. can be obtained by merely turning the handwheel at the front. An indicator at the side of the handwheel indicates speed at which the lathe is running.

NEW MATERIALS

Rust-Resistant Coating Developed by Scully

Scully Steel Products Co., 1319 Wabansia Ave, Chicago, Ill., has made available Type XP-320 graphite coating for rust prevention. This coating is spread on thinly and dries in from twenty to thirty minutes. It does not allow dust or dirt to adhere to the surface.

"Grainal" Alloying Agents Control Steel Composition

A group of alloys designed to assist the steelmaker in meeting more easily the close specification limits required by automotive, armament, machinery and other large industries is offered by Vanadium Corp. of America, 420 Lexington Ave., New York, N. Y. It is claimed that by the addition of only a few pounds of these "Grainal" ingredients ordinary carbon steels and low alloy steels attain hardness and other physical properties of more highly alloyed steels.

Observation indicates that the manner of functioning is entirely different from alloying agents in conventional alloy steels. It is thought that in addition to deoxidation for which other alloys are available, the new agents contribute to the fixation of nitrogen, the presence of which has been widely recognized as contributing to variable results in finished steels of otherwise identical physical and chemical properties.

"Carobronze" Bearing Alloy Has High Load Capacity

Manufactured by Revere Copper & Brass, Inc., and distributed by Wrought Bearing Metals Inc., 230 Park Ave., New York, N. Y., "Carobronze" hard drawn bearing alloy is claimed to provide higher strength, greater wear resistance and better machinability than ordinary cast bronzes. Further advantages are claimed to include better sliding properties, higher impact strength, and complete freedom from inclusions, porosity and blow holes.

The alloy contains 91.2 per cent electrolytic copper, 8.5 per cent pure tin, and 0.3 per cent phosphorous—the phosphorous content being closely controlled. It is supplied in three grades, each with physical properties best suited for the applications for which it is intended. Even in its toughest and hardest grade, the metal is said to retain a higher degree of ductility and shock resistance than other bearing materials. High loading capacity enables the designer to reduce considerably the length of bushings. Further metal savings are possible since the tubings are furnished to close tolerances. Tubing sizes are available from ¼ to 3½ in. in outside diameter, and round rods can be supplied in all sizes from wire up to bars about 3½ in. in diameter. Sheet and strip in a wide range of dimensions are also available.

TRADE PUBLICATIONS

ARC WELDING The Hobart Bros. Co., Troy, Ohio, is circulating a booklet, "Practical Lessons in Arc Welding," which gives general information and practical welding lessons. Price, 50 cents.

BEARINGS SKF Industries, Inc., Philadelphia, Pa. has just released a 36-page catalog, "SKF Spherical Roller Bearings," devoted to illustrations in mining, crushing, steel and allied fields. Information on bearing selection is also included.

GENERATING EQUIPMENT Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa. is circulating a two-page folder which provides information regarding construction features of Simpac generating equipment.

HOBBING DATA—Barber-Colman Co., Rockford, Ill. is circulating a bulletin which contains hobbing data, a collection of case histories of field performance of Barber-Colman hobbing machines and hobs.

HOISTING EQUIPMENT Coffing Hoist Co., Danville, Ill., has published a general catalog, No. G-3, which provides illustrations, specifications and prices of a complete line of hoisting equipment.

LABORATORY EQUIPMENT Precision Scientific Co., Chicago, Ill. is circulating a 24-page bulletin, No. 315, which contains illustrations, detailed specifications, and perform-

ance data on a wide range of thermostatistically controlled laboratory equipment. Applications discussed are accelerated aging of materials, disintegration tests, dehydration to determine moisture content, and preheating of material such as plastics.

MOTORS An illustrated folder, "Small Motor Selector Guide," containing essential data needed to properly fit the right motor type to any job and covering the entire field of small motor applications has been issued by Department 7 N-20, Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

PRECISION MACHINES Taylor Sales Co., Milwaukee, Wis. has just issued a series of bulletins which describe the operation and construction of dynamometers, drilling and balancing machines.

PUSH-PULLERS Owatonna Tool Co., Owatonna, Minn. has published a four-page bulletin, No. P-28, which provides specifications, prices and sizes of push-pullers.

SWITCHES Almo Mfg. Co., Newark, N. J., has issued a two-page folder which describes the advantages of Almo Mercury Switches.

WELDING Electric Controller & Mfg. Co., Cleveland, Ohio, has issued a four-page bulletin, No. 1211, which pictorially describes the operation and construction of weld timers and welder contactors.

NEW BOOKS

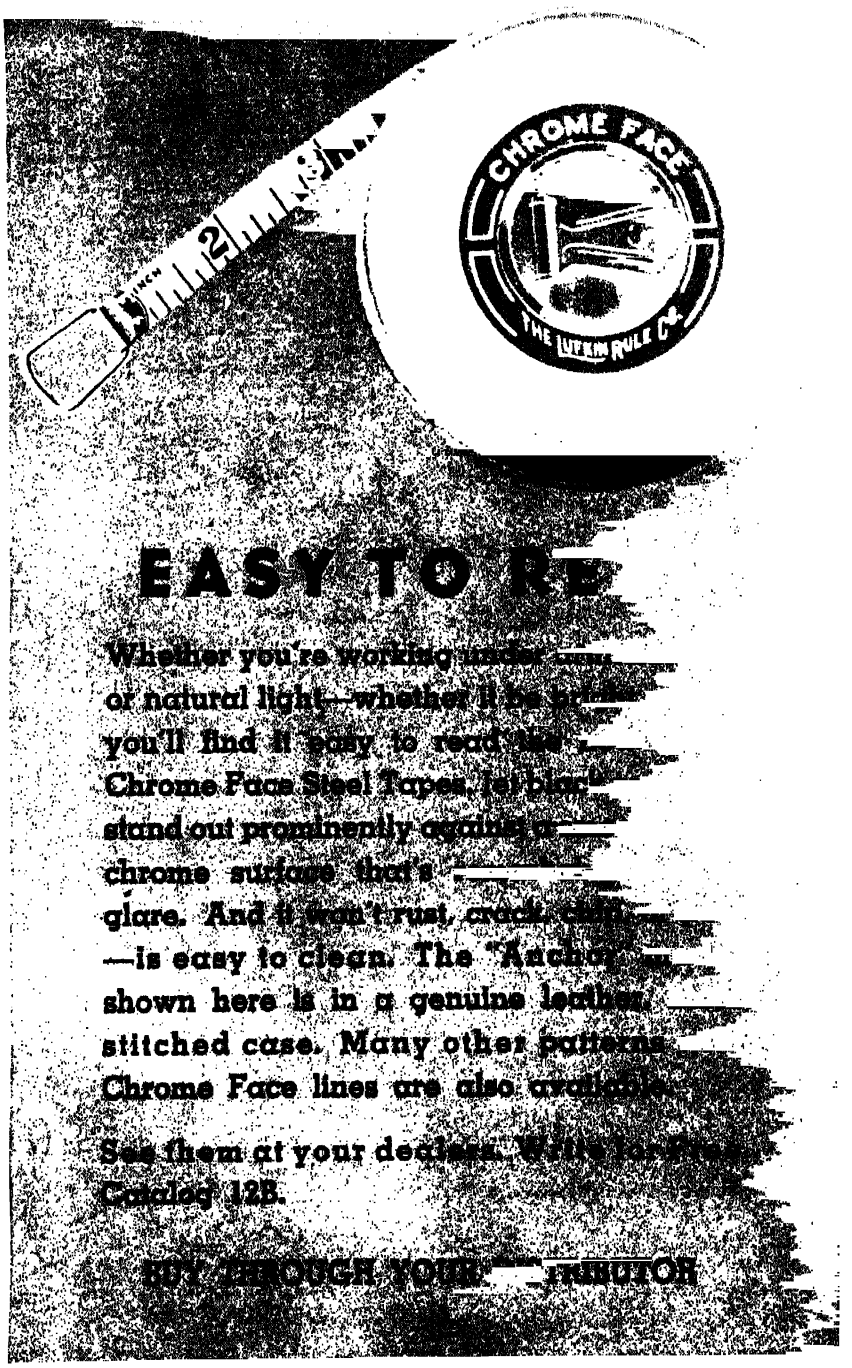
HANDBOOK OF ENGLISH IN ENGINEERING USAGE—*Second Edition. By A. C. Howell, Professor of English, University of North Carolina. 433 pages. Published by John Wiley & Sons, Inc., 440 Fourth Ave., New York, N. Y. $2.50.*

Engineering English is "boiled down" as much as possible, and frequently relies on illustrations, tables and curves to make clear its meaning. Nevertheless, ordinary principles of good English should be followed, whether the engineer is writing a letter or an engineering report. Poor writing almost always interferes with a man's advancement, whether he be an engineer or a member of any other profession. The fact that the writer is using terms familiar, for the most part, only to a given profession does not permit him to take liberties with good usage.

Both the beginner and the experienced engineer will find helpful suggestions in this second edition of the author's Handbook. Designed both for use as a handbook by the practicing engineer and as a text in college courses in English for engineering students, this edition has been arranged with an eye to clarity, accur-

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Canadian Factory
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acy and utility. Some ten years have passed since the first edition came off the press. During this time it has been recommended for the "Engineer's Bookshelf" of the Engineer's Council for Professional Development, and has been used as a desk manual by many private corporations and government bureaus.

TO THE EDITOR

More About Those Tenths

Dear Sir:

In the article by Ed West, entitled "When Is a Tenth Not a Tenth?" the emphasis was placed on temperature differences as being the cause of inaccuracies.

There is a lot of scholastic bunk written about tenths. The human element figures quite as much as temperatures. To prove this point I conducted an experiment as follows:

I got a piece of high-grade cast steel and had it turned up in a lathe, leaving a collar in the center the width of the micrometer anvil. The reason for this was that everyone would measure the piece in the same place. I handed it to the grinder and told him to grind it as true and smooth as possible without regard to size. Then I selected the three best men in the shop and asked them to give me the size in tenths. They all used the same micrometers, but got different readings varying a tenth.

I have been a toolroom foreman for over twenty years. I have never turned out a job that I could absolutely guarantee was to a tenth at a given temperature, and furthermore I have never found it necessary to do so. I can give you more proof that this tenth business is largely bunk.

During the last war I was in charge of the tool department of a munitions plant. We had a set of master gages from which our working gages were checked every day. Our master gages in turn were periodically checked by a government inspector. One day he handed me a plug gage stating that it was a tenth oversize, with the request that I have it corrected. I took it in my office and laid it on the desk and forgot all about it until the inspector called for it as he was ready to leave. I took it back to him myself, just as it was, without comment. He checked it over again and said, "Thanks, it's o.k. now."

I admit that to work to a tenth is possible if one has the proper conditions, but to hold a man to a tenth on a commercial job is all nonsense.

Yours truly,
J. DAVIES
Oshawa, Ontario, Canada

Dear Sir:

Careful consideration of the article, "When Is a Tenth Not a Tenth?" by Ed West invites considerable criticism. Mr. West makes inappropriate statements as to the general conception of the shop man's tenth. It is my thought that he misstates his contentions and that in his inner self he will agree with my criticism.

He states: "In many cases we find inspectors gaging work after washing or heat-treating processes and before the pieces have come down to room temperature." The "cases" in which inspectors worthy of their titles do not recognize the fact that heat affects the size of closely machined parts are certainly not "many"; and I base my deduction on many years of experience in inspection work and on my contacts with hundreds of inspectors.

Parts which are machined to such close tolerances are almost invariably so machined after heat-treating by grinding, lapping, etc., and there would therefore be no point in measuring so closely immediately following the heat-treating operation, not to mention the impracticability of making close measurements while the parts are still hot, or while covered with heat-treat scale and compounds.

Regarding the effect of heat on size, arising from washing in hot solutions, let us see what may take place. Some metals used in machinery manufacture, at points which might necessitate machining to close tolerances, are steel, brass and aluminum. Let us assume that a careless inspector or machinist just washed such parts in hot solution, and by the time he returned to his workbench and began measuring, the parts are still fifteen degrees above room temperature. The coefficients of expansion of these metals are 0.00000636, 0.00000957 and 0.00001234 in. per in. per deg. F., respectively. Assuming the dimension to be an inch, measurements under such conditions would yield errors of 0.0000954, 0.000143 and 0.000185 in. While these errors may cause trouble in some cases, they are small when compared with ordinary shop measurements. Gaging to the fifth decimal part of an inch—and we must gage to the fifth to definitely ascertain the fourth—should be and usually is done in specially equipped inspection rooms by men who know how to measure correctly.

A factor which is not mentioned by Mr. West and which is more conducive to error, yet is less noticeable than the difference in temperature, is that of cleanliness of both the object being measured and the instrument. An imperceptible oil film, or a film resulting from the cleaning operation itself, will cause quite a perceptible error.

Substitution of hard contact surfaces of measuring instruments with softer ones to obviate exertion of undue pressure, which may deform the part, will not eliminate this trouble. The solution will be found in dispensing with instruments which do not provide means of checking the pressure applied, and in building up the required size, whenever possible, with Johansson blocks and transferring it to the part by means of a height-gage and indicator.

If and where inspectors or machin-

lists dealing with fine measurements are so uninformed in elementary principles as Mr. West portrays, criticism should really be directed at supervision or management for failing to recognize and correct incompetence, rather than at the particular individual who lacks knowledge and experience.

Very truly yours,
GEORGE BELBES

Uniformity—Of Charts or Products?

By J. A. DOYLE
W. S. Rockwell Company

Pyrometry practice in the metallurgical industry is generally not up to the high standard maintained by instrument manufacturers. Emphasis on temperature control frequently leads to a disregard of the influence of other factors affecting uniformity of the product—factors which are just as important as those related to means for indicating and controlling temperature.

Much of our prevalent industrial heating practice is the equivalent of producing uniform temperature charts and non-uniform products. Evidence of uniformity in the chart is frequently offset by proof of irregularity in the product. Thus the practical effect of much of our elaborate provision for temperature control is that we are doing the wrong thing more conveniently.

A significant illustration of the prevalent distorted viewpoint on the relation of pyrometer to product is afforded by a specification for heat-treating equipment recently issued from an outstanding source. The specification disposed of the fundamental requirements for operation of the equipment—in terms of heat-treated product—in less than two lines. Yet there were about four pages devoted to detailed specifications of the mechanical characteristics of the temperature control equipment. Other essential factors that affect uniformity of product were ignored in an effort to indicate preference for specific means of indicating temperature at the end of a thermocouple, which may or may not represent the actual temperature of the product itself.

The need for control of time and rate of heating and cooling, because of varying shapes of the individual pieces, is well illustrated in the case of a gear blank and the gear cut from it. The difference in section and exposed surface produces a difference in the rate of heating and cooling which should be controlled equally with the time factor. The rate of heating should be slower, and the time required may be less, with the cut gear than with the original blank because of the difference in absorbing surface—even though they are heated at the same time, in the same chamber, indicating a perfectly uniform temperature.

The long-established practice of heating and cooling structural steel shapes and railway rails—*individually*—is in marked contrast to mass methods of heating and cooling bars, shafts and other expensive alloy steel products. If it is right in one case, then it is wrong in the other. Yet we find outstanding technical authorities defending such an illogical condition on the ground that pyrometer charts indicate the temperature required by specifications; that the mythical "time for soaking" offsets any irregularity The fact that individual pieces at the top and bottom of the mass may be exposed to different temperatures, for different times, and may react differently under the influence of the atmosphere, illustrates the difficulty of maintaining uniformity in the product under such conditions.

"Process specification" has been suggested as a means for achieving product uniformity. This is in no way intended to affect the metallurgical specifications, nor to indicate how the producer is to do his job. It permits him to write his own ticket for any desired standard of quality—whether good or poor—with any preferred composition of material or method of processing. It is proposed, as an amendment to the laboratory specifications, to effect better control of the individual heating and cooling operation to such a degree of uniform shop practice that will insure reasonably uniform products from day to day in the individual plant, or from different plants producing under the same specifications. It is primarily intended to indicate preferred methods of exposure or loading in heating and cooling, and the preferred rate of heating and cooling, time and exposure, which determines the actual temperature of the product, atmosphere and other essential factors.

Possibility for improvement is illustrated by outstanding accomplishments of the automotive industry in establishing higher standards of uniformity which are necessary for the proper function of its product. That industry has forced improvements in many other industries that otherwise would be likely to resist change, as many do today. Such improvement has been effected in production of ball and roller bearings, condenser tubes, steel sheets, wire, and a great many other products—in addition to an astounding development of new production equipment.

In the process of cooperating to determine why the product varies(when the pyrometer chart indicates it should be uniform) there will be developed a better understanding of the actual relation of uniform temperature charts to uniform products. Also a gradual realization of the fact that a lot of what we now think we know about uniformity really isn't so.

Abstracted from the American Institute of Physics Symposium.



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Wide World

New Gun—*Brigadier General G. H. Stewart examines the new Army rifle with its inventor John C. Garand*

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TO HELP YOU *help America*

(NUMBER THREE OF A SERIES)

THE *DEFENSE PROGRAM* gains momentum. So does American Machinist's new series of special sections on armament production — written to help *you* help America. Here are typical recent comments:

"We are interested in securing ten copies of "How to Machine 75-mm. Shells."—Clyde E. Hagler, Gen. Supt., Continental Gin Company.

"It seems to me that these articles (the Armament Sections) and others yet to come are the finest materials available to put into the hands of youths . . . who are trying to plan their specialized training in order to prepare them to be wage earners . . . "—R. B. McHenry, Director, Adult & Industrial Education, Tulsa (Okla.) Public Schools.

"I would appreciate receiving copy of the Sept. 18 issue which includes several items and pictures on armor-plate castings." -W. H. Hartwig, Production Mgr., The Symington-Gould Corp.

"Please send us AMERICAN MACHINIST *for a year—and send any armament reprints that you have on how to machine shells."- - Stanley W. Sparks, President, Sparks, Simplex Machinery Corp.*

"I have received copies of the Armament Sections. I find them interesting and useful."—Burton O. Lewis, Brig. Gen. U.S.A., Asst. Chief of Industrial Service Production, War Dept.

"I have held out one of these (copies of Armament Sections) for my personal use and turned the others over for distribution to interested personnel at this arsenal." —N. F. Ramsey, Col., Ord. Dept., Commander, Rock Island Arsenal.

★

Six special sections on Armament Production have already appeared. Another is in this issue. More will come in every succeeding issue of *American Machinist* — always first with the latest metal-working data. Watch for these sections — use them — they are authoritative.

WHAT'S IN THIS ISSUE

A THOUSAND A DAY

It isn't often that you run across an article like that beginning on page 969. As you may suspect from occasional hints dropped on this page, it's on the manufacture of the famous Garand semi-automatic rifle. There's been so much misinformation printed about this weapon that we know you'll be more than usually interested in our discussion of its design, performance and manufacture. It comprises virtually all of this number's Armament Section.

PICTURES FOR PERSUASION

Industrial expansion brings with it, among others, the problem of proper foreman training. At best this job is often overlooked or left to chance, but when all is confusion it is even less likely to be taken as seriously as it should. Hence we feel that a really effective improvement in foreman training technique is now particularly timely. This improvement makes use of the sound-slide film, a medium which is old stuff in the selling game but whose educational potentialities are only now being tapped. A review of developments and a report of progress to date are given by Merritt Lum on page 958.

ONE OR A MILLION

The dilemma of the shop faced with small-lot production will probably never be dispelled. But much can be eliminated simply by a fresh approach. You'd hardly think, for instance, that lots of a few dozen could be economically finished by centerless grinding. Yet such is often the case. Methods of figuring when centerless is most economical, and specific suggestions for cutting costs on small-lot runs, are given on page 960 by Robert W. Peaslee, president of Eastern Centerless Grinding Company. Eastern has been confronted with lots as small as 1 and larger than 1,000,000—just in case *you're* fretting.



ROBERT W. PEASLEE
. . . centerless only



DEAN M. WARREN
. . . light on the subject

FACTS OF LIGHT

No one would expect night production to go on unhampered with the lights off. Yet the loss in output caused by improper illumination often goes unheeded. With fluorescent lamps, even the old argument of operating cost can no longer be used as an excuse for inadequate lighting. Just what is the place of the fluorescent lamp in industry? What are the applications for which it is most suitable? What equipment is available? On page 955 Dean M. Warren, of General Electric's Nela Park Engineering Department, discusses advantages and limitations of the lighting industry's newest contribution to efficient seeing. His article includes considerable engineering data to help in estimating that particular job of yours.

STREAMLINED HINGES

Toward the end of the Armament Section, on page 984, you'll find a story on the production of piano-type hinges. These hinges are used widely in aircraft construction, and the method of making them should prove of extensive interest to all engaged in work of this type. The details are given by J. M. LaRue, of Cincinnati Shaper Company.

FINAL PASS

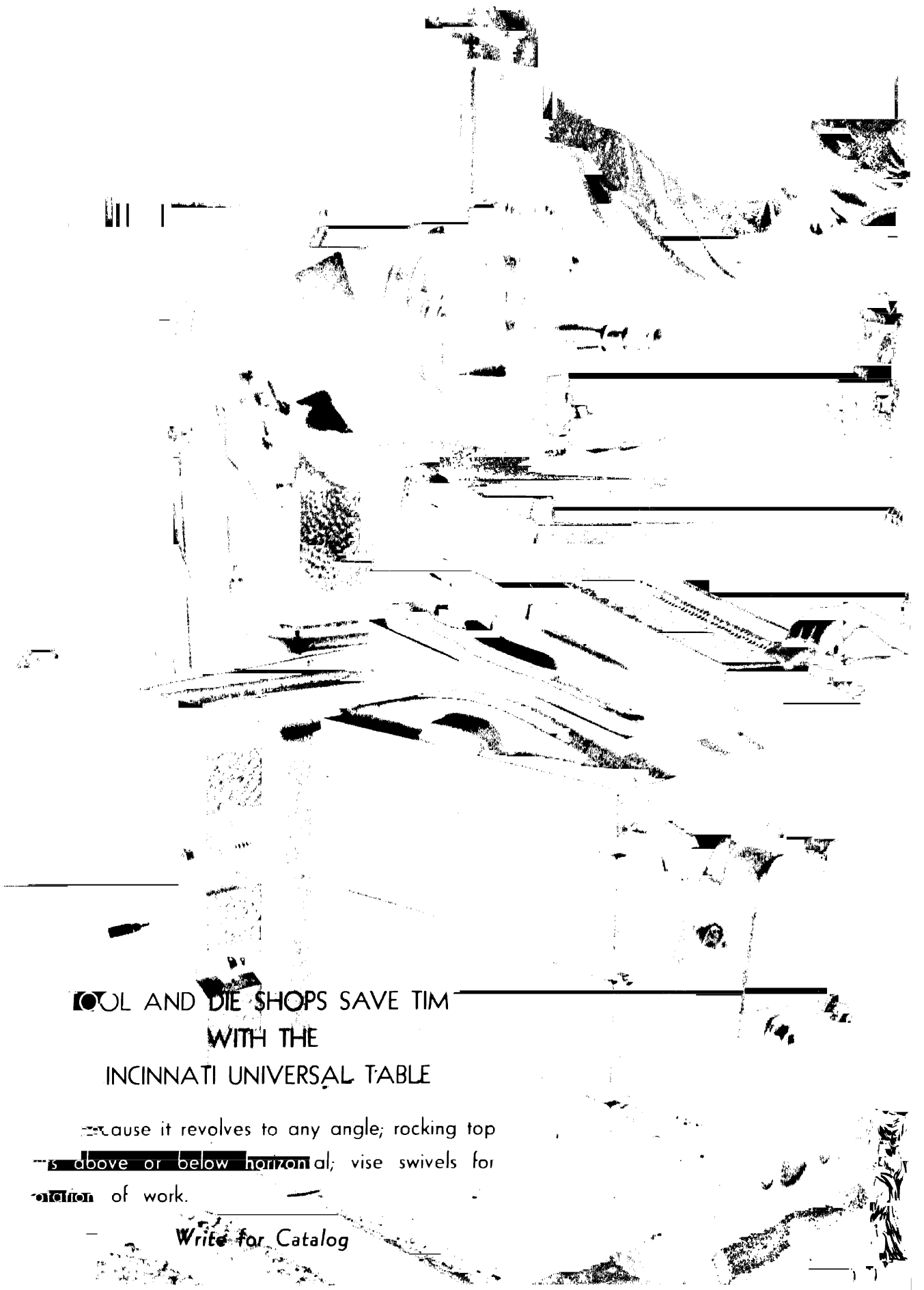
On page 963 we take our final pass at grinding wheels—at least for the time being. For on that page H. J. Wills, of the Carborundum Company, completes his series on dressing and truing grinding wheels. In his last installment he discusses mountings and uses of diamonds for most efficient wheel shaping.

COMING

Now is about the right time to unveil a series on the working of sheet aluminum—even at the risk of being a little previous, since the articles aren't scheduled to begin until the next number. We feel it's something to look forward to, though, as the subject is not only exhaustively treated but is of extreme present-day importance as well. The series has been prepared by several experts of the Aluminum Company of America, an organization which probably has accumulated more information on aluminum than any other in the world. Herewith we take pleasure in introducing to you the first two authors of the articles. At the left is Dr. L. J. Weber, while at the right is J. T. Weinzierl. In front of both is a drawing you'll soon see in AMERICAN MACHINIST.



DR. L. J. WEBER and J. T. WEINZIERL
. . . all about aluminum

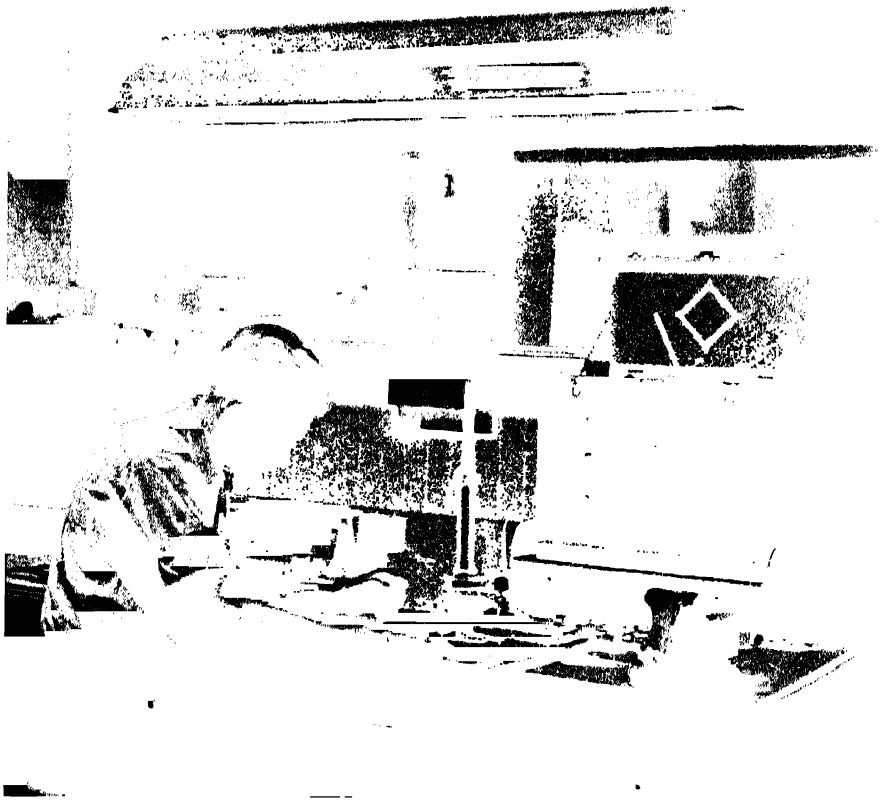


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Bench work requires a high level of good quality illumination. In this case it is provided by an RLM unit equipped with two 40-watt daylight fluorescent lamps

Fluorescent facts

BY DEAN M. WARREN, NELA PARK ENGINEERING DEPARTMENT, GENERAL ELECTRIC COMPANY

Like many other production aids, fluorescent lighting has certain tasks that it meets best. Here's engineering data to help fit it to proper jobs

SPEEDING UP OUTPUT to meet present demands has forced industry to take immediate advantage of every known production aid. Good lighting is a proven aid. The newest source for providing illumination levels required for quick and efficient seeing is the fluorescent lamp. Outstanding advantages of this lamp are:

1. It economically produces light of daylight color quality.

2. It permits higher lighting levels to be obtained with existing wiring, provided power factor correcting equipment is used at the lamp.

3. It produces cooler illumination, an important factor in obtaining high-level lighting with comfort. One-hundred foot-candles are now entirely practicable from this standpoint.

The fluorescent lamp is of the electric discharge type, employing mercury vapor as the medium for maintaining the arc. The tube converts invisible ultraviolet energy, produced by the arc, into visible light by fluorescent powders which coat the inner surface of the tube.

Fluorescent lamps are at present made in six wattages, six lengths and four diameters. Wattages shown in the specification table do not include the watts consumed by auxiliary equipment. This amounts to from 20 to 30 per cent as much as the lamp.

In common with all electric discharge tubes, fluorescent lamps must have auxiliary control equipment. Specifically designed control units are required for each wattage, frequency and voltage range. This equipment is



Continuous rows of 40 watt fluorescent lamps provide machinists with 40 foot-candles of well diffused lighting

available for operating either a single lamp or two lamps, the latter being designated as a Tulamp ballast Both correct power factor to better than 90 per cent For 30 and 40 watt lamps Tulamp ballasts are more economical than individual ones for each lamp In addition, they reduce stroboscopic effect by causing the lamps to operate out of phase with each other so that the light fluctuation becomes comparable to that of low wattage filament lamps Plants that have installed fluorescent lamps prior to the development of high power factor ballasts, and who have not thus far made correction, will find it to their advantage to correct power factor by installing a capacitor These are available today which correct as many as five lamps to 90 per cent power factor or better, thus enabling efficient utilization of the wiring

The fluorescent lamp is designed to give its best all-round performance within the specified voltage range Lowering the voltage will not necessarily increase the life of the lamp as is the case with filament lamps, because such treatment places a greater burden on the electrodes, causing them to operate too cool Excessive voltage causes a shortening of life because of the more rapid use of electrode material Enough data are not yet available to establish definitely the magnitude of the effect of under and over voltage operation on lamp life For the present it appears that from a life standpoint the lamps should not be operated at voltage less than 105 (210) nor more than 125 (250), and wherever possible the lamps should be burned within the recommended range of 110 125 (220 250)

In general, fluorescent lamps lose their usefulness because of decrease in light output before they fail The rate of depreciation in light output diminishes throughout life, the first 100 hours produce about as much darkening as the following 1000 hours

Frequent starting of lamps may take more life out of electrodes than long hours of operation If a lamp is started once a minute for example, the hours of use will be shorter than normal, but if it is turned on and operated continuously its life will be longer than usual When the active material on the electrodes is nearly exhausted the voltage required for starting will rise and may exceed the available supply This may occur after the lamp has been started thousands of times or burned beyond its rated life

During about the first 100 hours of operation, the light output from fluorescent lamps drops considerably, often as much as 10 per cent For this reason the lumen outputs given in the table are based on readings taken after this initial loss has occurred Since the output from new lamps is considerably greater than published values, foot candle readings taken shortly after making complete installations of new lamps may be somewhat higher than the illumination level designed

Introduction of new light sources always results in some confusion as

Physical and Electrical Specifications of Fluorescent Lamps

	18-inch	24-inch	36-inch	48-inch	58-inch	60-inch
Nominal Watts....	15	20	30	40	85	100
Circuit Voltages...	110–125	110–125	(199–216) (220–250) (110–125)	(199–216) (220–250) (110–125)	(95–125)* (190–250)*	(199–216) (220–250) (110–125)
Diameter, Inches .	1	1½	1	1½	1¼	2¼
Rated Life, Hours.	2500	2500	2500	2500	3000	2000
Lumens — Daylight.....	495	760	1250	1800	. . . . .	. . . . .
Lumens — White..	585	900	1450	2100	4000	4400
Lumens — Bluish-White.....	.....	.....	.....	.....	4000	.....

* Auxiliaries equipped with tap changing switches to provide for prevailing voltages.

to their proper application. This has been true of the fluorescent lamp. It is a low-powered source and this naturally places some limitations on its use. A sound practice is evolving and fields of logical application are being extended as new equipment is developed. Before introduction of the 40-watt 48-in. lamp and the 85-watt 58-in. lamp, fluorescent lighting was largely confined to supplementary installations. The 85-watt lamp, the 100-watt lamp and the recently developed RLM unit using two 40-watt lamps can serve as general light sources. The accompanying tables give approximate foot candles obtained for various installations.

One of the outstanding features of the fluorescent lamp is the precise and efficient manner in which light of daylight color quality is produced. Light from the daylight lamp is the nearest approach to natural daylight that it has ever been possible to produce directly by an artificial illuminant at high efficiency. This immediately suggests the use of the lamp for operations requiring color discrimination. For such work North Skylight and Noon Sunlight equipment has long been available. One shortcoming of such equipment is the high wattage required, which too often results in a compromise with foot-candles produced. With the fluorescent lamp high levels of daylight quality can be provided with no discomfort from radiant heat.

It might seem that the ability to see objects in their true colors is important only when actually matching two pieces of material or when it is desired to see colors in their original conception, as those of an oil painting. But colors can help very much fundamentally in the process of seeing. For example, in looking at a brass bushing on a steel machine part, the two metals might have exactly the same reflection factor and yet be indistinguishable under light which does not show their true colors. Since, in a great many applications, it is color difference which renders objects instantly recognizable and which reveals the line of demarcation between them, color discrimination is important from a utilitarian point of view.

Both the daylight lamp and the white lamp, which produces light of a color quality approaching that of the daylight filament lamp, are being used as supplementary sources to provide high-level illumination for inspection and for lighting lathes, work benches, etc. Two characteristics of the lamp make it quite suitable for such applications: its low brightness and its coolness. The former is important because the majority of seeing tasks performed in these locations have to do with reading scales, micrometers, or observing work which is of a polished or semi-polished nature. Researches made by the Illuminating Engineering Society have revealed that highest visibility is obtained when a source of large area and low brightness is employed. Fluorescent lamps in suitable reflectors may be so classified. Cool foot-candles are important because the source is generally located about 3 to 5 ft. above the workman's head.

Lighting economies have always involved quality and general satisfaction as well as costs, and the problem of true economics has never been revealed by arithmetic alone. Fluorescent lamps produce daylight economically, which filament lamps cannot do. They produce cool foot-candles and are sources of extended area and low brightness. Their industrial application today is in cases where these qualities are sought.

Average Foot-Candles Produced by 85-Watt RF Fluorescent Lamps

Area per outlet and approximate spacing	Distance from reflector to floor to be not less than	Conditions	Average foot-candles
55–65 sq.ft. 7¾x7¾ ft.	7½ ft.	Favorable	30–36
		Average	24–30
		Unfavorable	18–24
65–75 sq.ft. 8½x8½ ft.	8½ ft.	Favorable	26–31
		Average	21–26
		Unfavorable	16–21
75–85 sq.ft. 9x9 ft.	8½ ft.	Favorable	23–27
		Average	18–23
		Unfavorable	. . . .
85–95 sq.ft. 9½x9½ ft.	9 ft.	Favorable	40–48*
		Average	32–40*
		Unfavorable	24–32*
95–110 sq. ft. 10x10 ft.	9½ ft.	Favorable	35–42*
		Average	29–35*
		Unfavorable	22–29*

* Two lamps at each outlet.

Foot-candles for Continuous Rows of 40-Watt Daylight Lamps

Area per reflector or spacing between rows	Reflector to floor to be not less than	Conditions	Average foot-candles
21.6 sq.ft. 5 ft.	7½ ft.	Favorable	67–74
		Average	50–62
		Unfavorable	37–50
26 sq.ft. 6 ft.	7½ ft.	Favorable	51–62
		Average	41–51
		Unfavorable	31–41
30.4 sq.ft. 7 ft.	7½ ft.	Favorable	44–53
		Average	35–44
		Unfavorable	26–35
34.6 sq.ft. 7 ft.	8 ft.	Favorable	39–46
		Average	31–39
		Unfavorable	23–31
39 sq.ft. 9 ft.	8½ ft.	Favorable	34–41
		Average	27–34
		Unfavorable	20–27
43.3 sq.ft. 10 ft.	9½ ft.	Favorable	31–37
		Average	25–31
		Unfavorable	18–25

These values are computed for two lamps in each reflector.

Pictures put it over

BY MERRITT LUM



When it comes to ironing out personnel problems, a foreman skilled in human relations can be as competent as a family doctor

Any foreman skilled in human relations can work wonders in keeping production humming. But how to train him? Here's a realistic, effective method

"AT LAST we've got our supervisors really interested in human relations!" This was the enthusiastic statement of the plant manager for a New England metal-working company at a meeting of industrial executives.

It was a frank confession. At first, it startled the group; then it brought forth admissions from most as to the difficulties of training supervisors in personnel relationships.

"It wasn't our material that was at fault," this New England manager continued. "Rather, it was our method. Thank heaven we've found the answer to that problem."

That evening the answer was shown to the entire group. There was no secrecy about how it was found. The turning point was recognition that even the most valuable and fundamental principles of action are apt to go in one ear and out the other—to gain lip service, but not reality in action. It was recognized that only as principles of action are made realistic, vivid, and expressed in terms of moving human experiences of John and Bill, do they press home.

Hence this New England company had turned to the sound slide film as the key to its entire training program. The company official who had embarked on this venture soon learned that developing a convincing presentation was not quite as simple as it looked. There proved to be far more to it than putting together a series of interesting pictures and accompanying dialogue. It took his company about a year to produce its first acceptable picture; through trial and error a satisfactory job finally resulted.

When the film was shown to supervisors, even though the subject was a familiar one—turning down requests —they seemed to get the principles as never before. They remembered them. They began to discuss them, not as copy-book maxims, but in terms of every-day actions and problems. And they voluntarily began to apply these principles in their work. The realism got home.

The over-all effects were so marked that no time was lost in planning future productions. Soon it became apparent that there was a need for joint effort by which this dramatic-experience training method could be made available to companies throughout the country. Last fall the National Association of Manufacturers became interested in the project, and appointed a special committee to oversee production of a program broad enough to be utilized by most plants. The production task was assigned to a group of specialists in the art of dramatization.

As the committee got into the question of improved training technique, it found a great variety of subjects for which the dramatized case experience type of presentation was needed. Association members reported their requirements. From the wide field the committee chose for initial production six subjects as being representative of current needs. Topics on which films have been, or are being, produced are: *The Supervisor as Manager, The Supervisor as Trainer, The Supervisor as Leader, Letting Men Know Where They Stand, The Reprimand,* and *The Grievance.*

Insight into the practical character of these new films is gained by the sample shots reproduced herewith. These are taken from more than 100 scenes included in the third film—the one on leadership, entitled "When Something Goes Wrong." In a running sequence of factory scenes, the story of actual contacts is told by sequence and voice, reproduced so naturally that attention is effectively concentrated on the events portrayed.

Almost universally, when supervisors have seen this film, they have exclaimed, "Why, that might have been me!" or "That's my problem!" Thus the ground is laid for a lively, realistic discussion between supervisors on how to improve their shortcomings, how to tell where training is needed, how to make it more thorough. Although aiming at a specific problem, the film covers much ground.

Although the six initial films form a course in major industrial relations, they need not be used in any given order. Each is self-contained. With each is a specially developed discussion guide. Requiring fifteen minutes for each showing, the films are a welcome springboard for discussion groups. They can be used to brighten and intensify mass meetings.

Harrassed managers and training directors have asserted that this program will do "a job that we have been unable to do. It puts over our story in a way that not even our most thoughtful suggestions, our lectures, our writings seemed able to do."



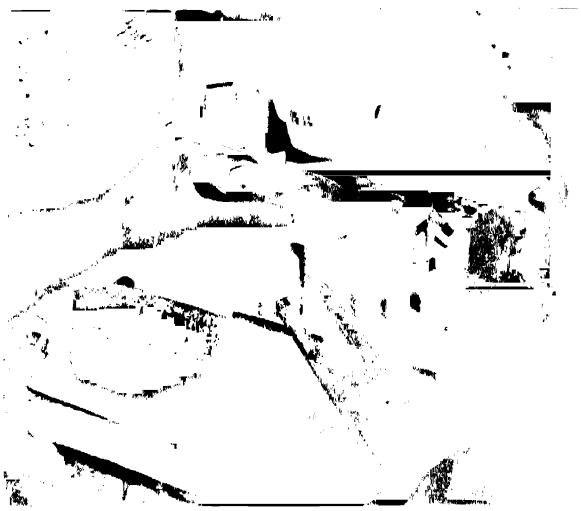
"You're way over your spoilage quota, Dick," a supervisor tells a foreman. "Let's see if we can't get at what's back of it . . ."



". . . The other day you told Mike, 'Say, if I took time to explain everything we'd never get work out.' Shouldn't we study that approach?"



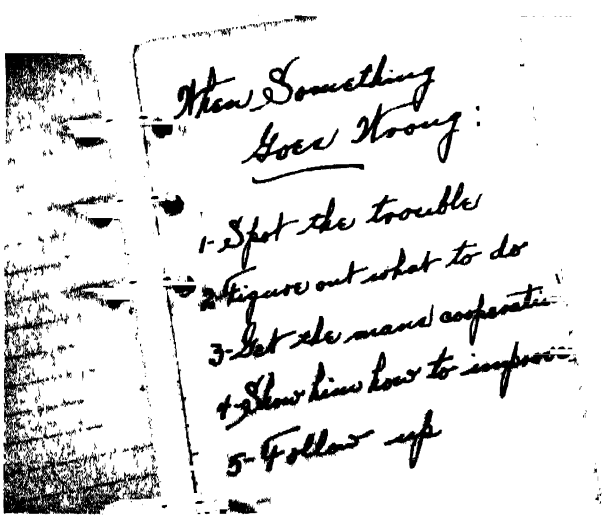
Dick makes a new approach in his relations with his men. He takes time to spot their trouble



"There seems to be some trouble in seating it, Mike. I notice you pull your hand back . . ."



By careful analysis Dick spots faults, and by tactful suggestion gets his men to correct them



Dick now has a program for "when something goes wrong." To him it's as important as specifications



Small-lot centerless grinding is most economical when set-up changes are held to a minimum Work is usually scheduled to consist of all through-feed or all in-feed, with diameters running progressively from largest to smallest Here is a centerless machine set up for grinding 2½-in. diameter bars

Centerless for small lots

BY R W PEASLEE PRESIDENT EASTERN CENTERLESS GRINDING COMPANY

Huge quantities aren't needed to achieve economical centerless grinding. The secret lies in proper production planning

A GENERAL but erroneous opinion is that centerless grinding is exclusively adapted to large lot mass production

Actually the centerless grinder is as well suited to short runs of widely different and frequently changed parts as is any machine tool If it were not, this company could hardly keep operating for we do a strictly jobbing business in centerless grinding In fact, we have no machines except centerless grinders

Occasionally we get an order for a million or more identical pieces on which a machine can be kept busy for several weeks These are few and far between More often our orders go to the other extreme—a lot consisting of a single piece The bulk of our business is made up of lots of from about 25 to 500 pieces each

We can handle economically a wide variety of work Materials include cast iron, steel of various analyses and hardness, aluminum, copper, brass, bronze, enameled iron, and many types of plastics Changing materials usually calls for considerable down time, for it is frequently necessary to change wheels and coolant—which involves complete cleaning of the machine and coolant tank

In the drawing, page 962, is a typical batch of parts to be ground on one machine The sketches are in the order in which the orders were received Numbers refer to quantity to be produced Each job, of course, requires its own set up In most shops which make standard products even a wide variety of them—it is possible to hold up a small order until enough similar parts have been accumulated to get a fairly long run This is seldom possible for us, for many of our orders give us only a couple of days in which to make delivery However, it is sometimes possible to accumulate several less urgent orders for parts made of the same material and run them through together

Some Ways to Save

The secret of economical centerless grinding of small lots is intelligent production planning This does not call for elaborate planning boards nor

complicated paper work It is a matter of common sense and knowledge of the time required to change the set up for one part to a set up suited to another

It takes less time to change the set-up for a through feed job to that for another through feed job than to change from a through-feed job to an in-feed one Therefore when planning the day's production for a certain machine we try to make it all through-feed or all in feed

Next we try to group lots of parts whose diameters are not too different, so that the changes in set up will come in as small steps as possible It takes longer to make changes for large differences in diameter than for small ones

Take the typical jobs illustrated They were scheduled in order of diameters starting with the largest, and ending with the pound of brass wire All were through-feed jobs If these parts had been put through in the order in which they were received, each set up might well have taken from 30 minutes to an hour But when scheduled so that they were processed in the order of declining diameters the set up times were from 15 to 25 minutes each This procedure is elementary, of course, but it is often overlooked or ignored In it lies the secret of economical centerless grinding of small lots

How to Compare Costs

Since we do nothing but centerless grinding, we do not have to determine whether it is the most economical method for a given job Our customers decide whether a part shall be centerless ground But for the shop which has both centerless grinders and cylindrical machines, it is handy to have some method which will help decide which method will be more economical

Here is a simple formula which, while not absolutely accurate, is at least indicative Let

ML = Value determining whether the work should be ground on the centerless grinder,

A = Set up time for centerless grinder,

B = Set up time for cylindrical grinder plus time required for drilling center holes and an allowance for truing center points,

C = Grinding time for cylindrical grinding each piece,

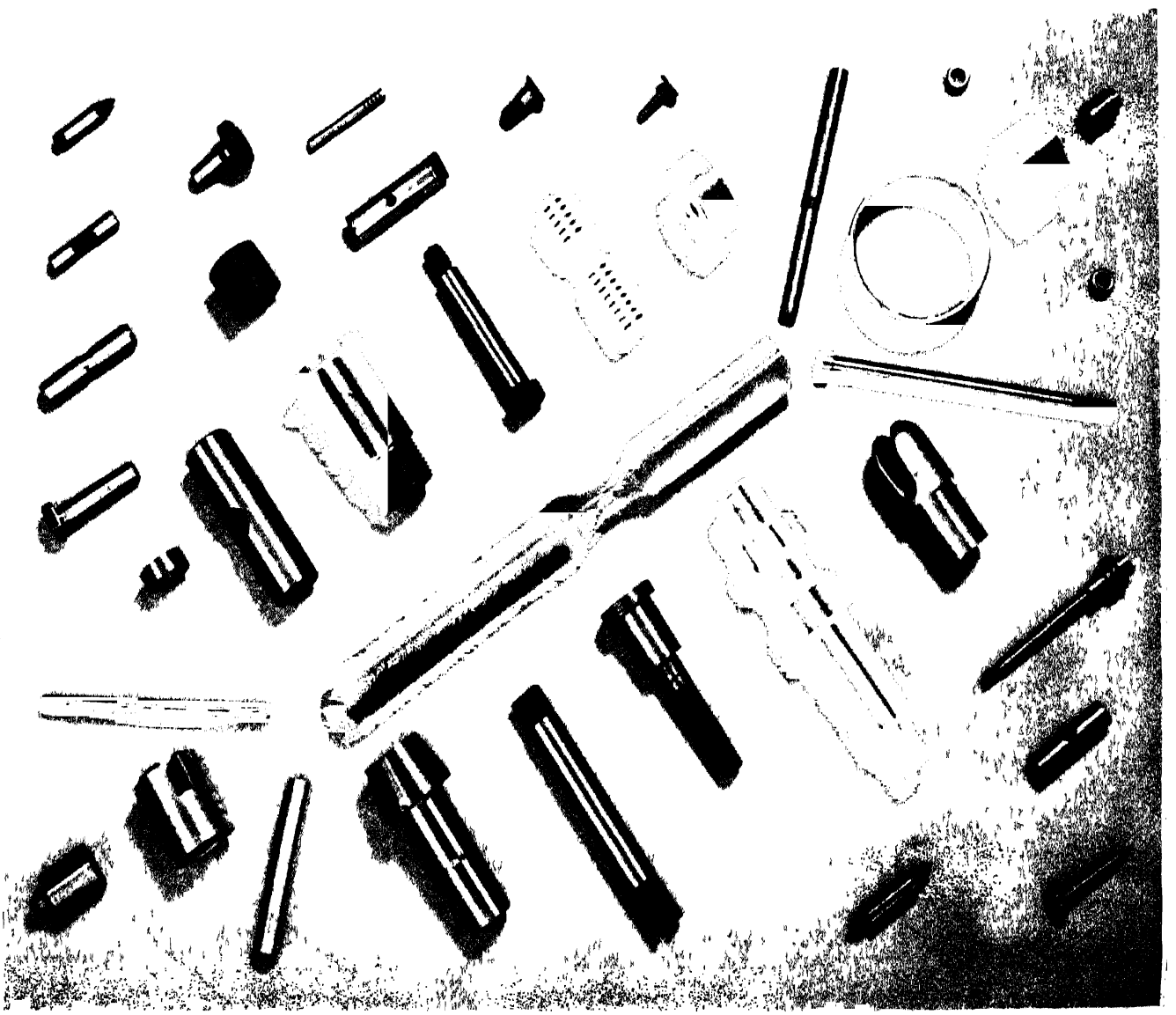
D = Grinding time for centerless grinding each piece

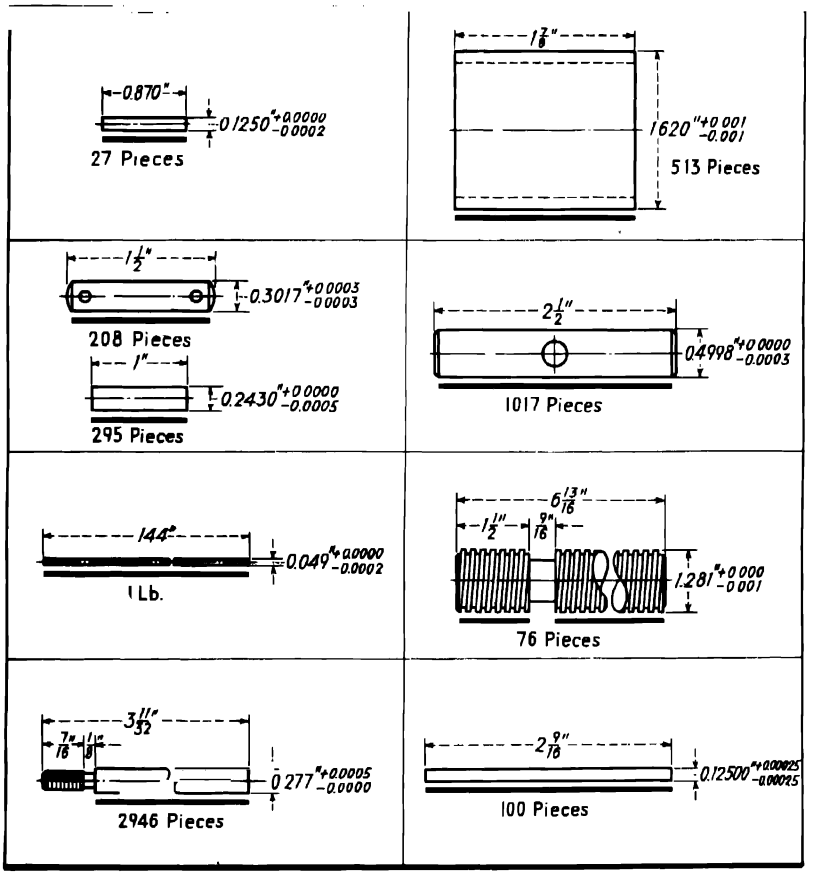
Then

$$ML = \frac{A}{C} - \frac{B}{D}$$

If ML is less than the quantity in the lot, theoretically the job can be more economically done by centerless

These widely differing parts were all finished economically by centerless grinding Quantities ranged from 1,000,000 for the small iron core in the extreme upper left to 1 for the slotted shaft at the bottom Tolerances were often of the order of two or three tenths Materials below include iron, steel stainless steel brass Bakelite, aluminum and transparent plastic for the center handle





If ground in the order in which they were ordered, each of these parts would have necessitated about an hour for setting up. Scheduling them from the largest diameter progressively down to the smallest cut set-up times to an average of about 20 minutes

grinding. If *M.L.* is greater than the lot quantity, cylindrical grinding will be more economical. However, if the difference is slight and if the centerless machine has time available, it may be better to assign the job to the centerless.

Incidental Economies

There are other factors which may make it desirable to do a job by centerless grinding even though the formula indicates that it will be more economical to do it on a cylindrical machine. Since there is no deflection in the piece caused by wheel pressure, the danger of inaccurate work and poor finish from that cause is eliminated. Since there is no axial pressure, as when work is ground between centers, that cause of possible inaccuracy is eliminated. These factors tend to reduce losses from spoiled work—resulting in an additional time saving which is not taken into account in the formula.

However, this is not intended to be a treatise on the advantages of centerless grinding. The point is that long runs need not be available in order to make centerless grinding economical. If the foreman or production man knows his machine and has detailed knowledge of what makes for quick, inexpensive set-ups, a diversity of parts in surprisingly small lots can be effectively handled on a centerless machine.

Saving Time and Teachers in Training

MASS TRAINING requires mass instruction. The old method of individual teachers is as much out-of-date as individual assembly in a motor shop. There are not enough teachers and it would take too long, if there were.

Visual education, by the use of moving pictures, has proved successful in mass education. It has been used by the Signal Corps, the Ordnance Department of the Army, and by the Navy, and has proved to be a great time saver. The Navy used it in teaching firemen who were brought up on coal, to handle oil burners. The Ordnance Department uses it in teaching the action of shrapnel.

The operation of machine tools, in general, or of special operations, can be shown so clearly that the time of personal teaching can be greatly reduced. In some cases "slow motion" helps greatly. In others some form of "animation," as done by Bray and Disney, makes clear the workings of parts that are not visible to the eye. It makes it much clearer than even a sectional machine, which cannot be operated.

This method can be used to great advantage in training ground crews in aviation. As every plane needs eight men on the ground, the training of the ground crew is a gigantic task by the older methods. Pictures can show the handling of planes in and out of the hangars. They can show just how motors are removed and put in place. Slow motion of the sequence of operations in disassembly can show a large class the routine to be followed. The same is true of inspection for wear, of defects that warrant rejection, and of re-assembly of units and complete motors.

Competent instructors will be needed to handle special problems as they come up. But pictures can relieve them of much of the teaching routine, and help produce trained men in less time.

When the students start to handle the parts or the machines, the pictures can be run again to refresh any lapse of memory. It might even be well to use one of the commercial projectors which run continuously, showing the whole reel at regular intervals. Such a continuous showing would enable any student to see just the point on which he is hazy, and possibly save making an error that would damage both work and machine, in the case of shell turning, or similar munitions work.

Builders of machines to be operated by newly-trained men, makers of airplane motors and their accessories, propellers or landing gears should find it advisable to have such films prepared. The Air Corps could use several such films in training the ground crew. They might well cooperate with the builders in having suitable films made.

Pictures alone will not produce trained mechanics. But they can help instruction more than many realize.

How to use truing tools

BY H. J. WILLS ENGINEER THE CARBORUNDUM COMPANY

The forming of fillets and convex or concave surfaces on the face of a grinding wheel requires considerable care in the selection and operation of tools

SMALL RADII for forming fillets, or to give the advancing edge of the wheel clearance, commonly are formed with an abrasive stick dresser If the face of a wheel must have a precise convex or concave radius a diamond should be used in a precision radius truing fixture such as those shown in Figs 17, 18 and 19 It is a good plan, when a wheel s sides act too soft, to diamond dress the sides of the wheel to a depth of several inches, and then dress the periphery

When the same contour must be formed repeatedly on wheels, a steel profile templet or cam should be provided This templet is rigidly mounted on the grinder directly opposite the wheel The diamond holder pivots on a fulcrum and is firmly held in contact with the templet As the diamond is traversed across the wheel, the templet guides it into the wheel face This saves time over hand truing and insures that the form al ways will be the same The tool pivot bearing must not be too loose, or the tool will gouge the wheel and the diamond will not follow the cam exactly

Thin edges or sharp corners on the grinding wheel call for sharp dressing tools A dull tool will require so much pressure to make it penetrate the wheel that the weak edges are apt to be chipped or broken The cut should start at the weakest point and if possible, should be taken from the extreme periphery toward the arbor

Many cylindrical grinding jobs, whether done between centers or in a centerless grinder, involve grinding several diameters simultaneously If the corners must be sharp, truing requires considerable skill and often must be done with special equipment

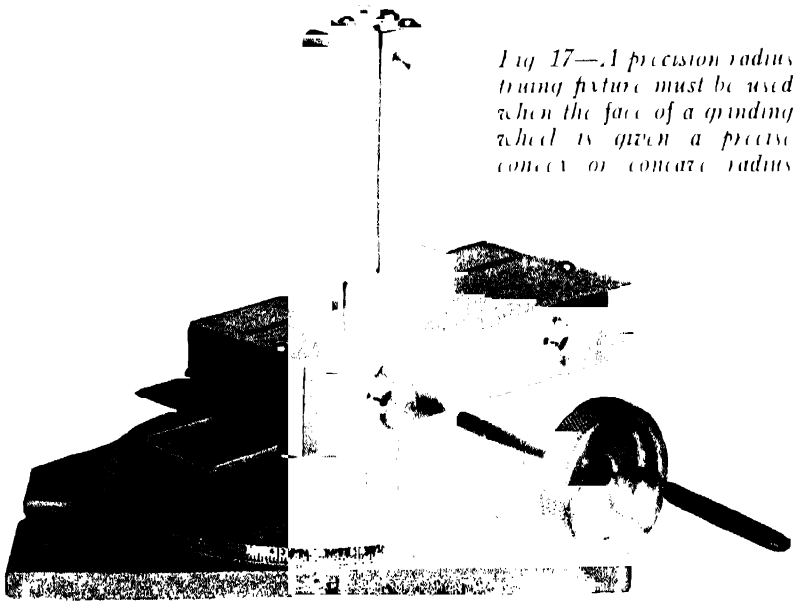


Fig 17—A precision radius truing fixture must be used when the face of a grinding wheel is given a precise convex or concave radius

One method is to use the offset diamond holder shown in Fig 20 This usually is a 'drop' shaped stone, which must be large so that it can be firmly mounted with enough of the stone projecting to reach into the corner Objections to this method of forming sharp corner are that the large diamond is excessively expensive, the necessary overhang from the mounting is a prolific cause of diamond breakage, the tool cannot be turned to maintain a sharp edge, and only a few truings can be done with a single setting of the stone Another method is to use an ordinary stone in the offset adapter shown in Fig 21. With this adapter, the tool can be turned to provide sharp edges, but the long overhang may cause vibration in the tool

The diamond shown in Fig 22 is lapped to cut a right angled corner It has the advantage that it can be set close to the wheel and so obviate vibration However, it is an expensive tool and is useful only so long as the lapped edges stand up The hardest, and therefore the most useful, part of the stone, the skin is lapped away in forming the stone by this method The adapter shown in Fig 23 permits advantage to be taken of the cleavage planes in both of the two directions in which the stone may be set

Since wheels used for snagging and fillet grinding should remove material rapidly, it is essential that their faces be rough and open The *star* or Huntington dresser is used It is held in a single location until the wheel is sufficiently dressed, then moved three fourths of the tool width and dressing is repeated until the wheel face is completely dressed Truing the face of the wheel slightly convex will increase its life If the wheel is of too hard a grain or too fine a grit for the purpose, corrugate or ser-

rate the face by locking the dresser disks in series of patterns, so that they cannot rotate as individuals on the pin. A rigid dresser support is essential in dressing snagging wheels.

Surface grinding wheels for roughing may be dressed with a silicon carbide dressing stick mounted with sulphur in a cast-iron holder. This holder is supported by the chuck, while the wheel is passed over it at a fair cut. If the wheel is to be subsequently used for finishing, from 0.003 to 0.005 in. stock should be left on the work. To dress the wheel for finishing, use a slow traverse and take a light cut with a diamond. Since surface grinding often is done dry, the dressing also should be dry, and plenty of intermissions allowed for cooling.

Ring and segmental wheels are dressed best with a Huntington type dresser, provided it is properly supported. If a smooth surface is required, the precision steel type dresser is best.

When large resinoid-bonded wheels have tracks worn in their faces, they may be trued to a commercially perfect plane with a Huntington dresser held in a bar guide. For dressing

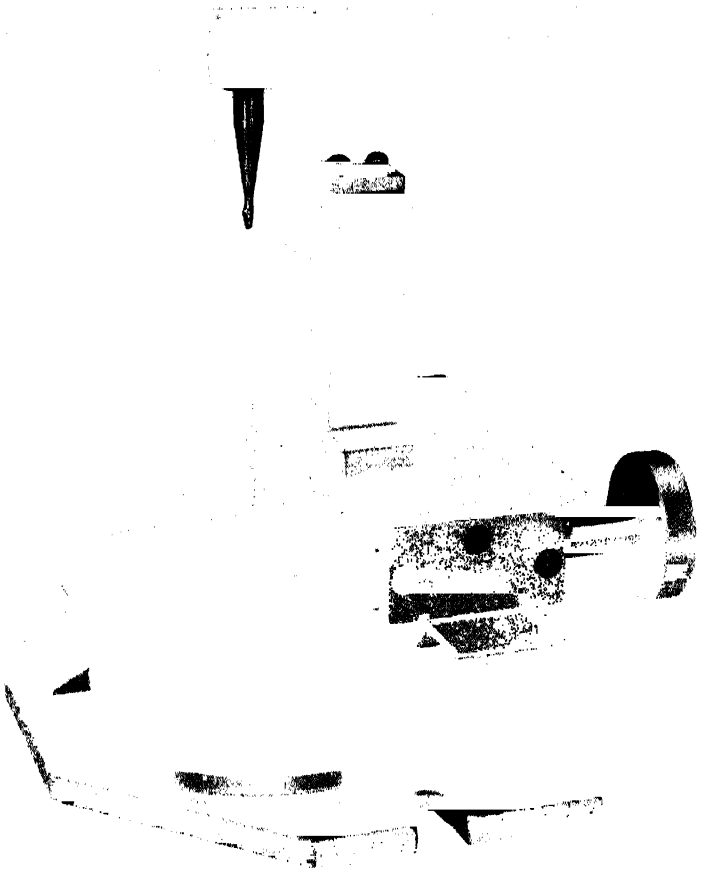


Fig. 18—For some contour-truing operations, this type of diamond holder is of advantage

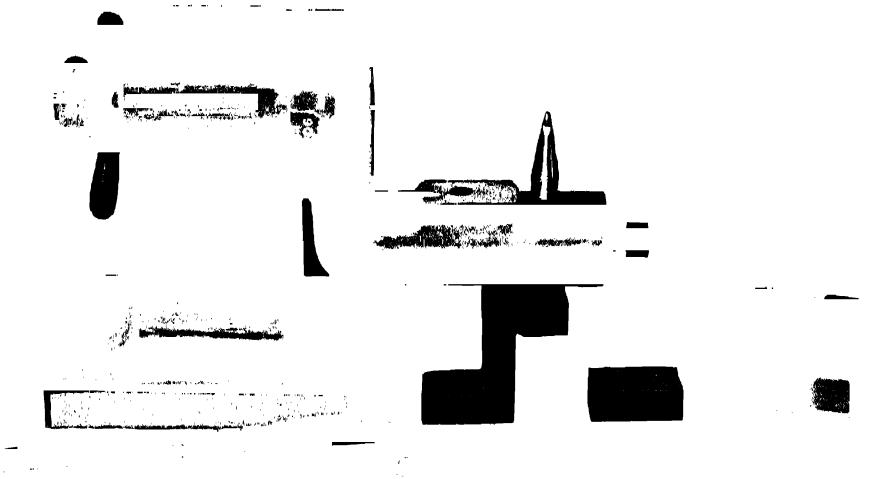


Fig. 19—This form-truing fixture is adjustable for truing in a horizontal or vertical plane, and has a special gage for setting the diamond on center

only, the wheel may be held in the hand. Double disks which are parallel to each other must be dressed with a double wheel dresser. If possible, the disk should be dressed from the center outward in order to allow the cuttings to be thrown free of the wheel.

Except for surface grinders, all toolroom wheels are rough formed with silicon carbide sticks held in the hand. Sharp corners, small radii and finish forming is done with a diamond tool, held in an adjustable mount, such as shown in Figs. 17, 18 and 19, or with a hand-held tool.

For the run of cylindrical grinding jobs, the wheel may be dressed satisfactorily for roughing by passing a diamond rapidly across the face with a tool feed of not more than 0.001 in. One pass usually will be enough. If the same wheel is to be used for finishing, make one pass at rapid traverse with a tool feed of 0.0001 to 0.00015 in. for a soft wheel. If the wheel is hard a feed of 0.0005 in. may be used. Then reduce the traverse by a half and make one or two passes with a feed of 0.0003 to 0.0005 in. Repeat without dresser feed to remove any high spots.

With this method of truing, threads may appear on the first few pieces ground, but the cutting action of the wheel will be rapid and the finish good. If only one piece is to be ground, or if it is necessary to have a fine finish on all pieces in a lot, this dressing procedure should be followed by several passes at diminishing feeds and traverse. This will reduce the cutting action of the wheel, which must be compensated for by adjusting the wheel feed when grinding.

If a wheel loads when taking a roughing cut, the bond may be broken down by serrating the face by deep diamond cuts at a very rapid traverse.

While many cylindrical grinding wheels may be dressed inexpensively with an abrasive wheel dressing tool, diamonds are recommended.

Since some chilled iron rolls need not have a high quality surface, diamond expense can be saved by dressing with an abrasive wheel, or steel tool. If a better finish is required,

iron and dull grains may be removed with a *star* dresser and a diamond can be used for giving the final finish. This saves diamond cost, but does not reduce dressing time.

Hardened steel and chilled iron rolls which are to be used for cold rolling must be ground to close tolerances and given fine surfaces and finishes. The grinding wheels must be dressed carefully and skilfully with diamonds. While no special precautions or methods are called for, it is important that the edges of the wheel be rounded before and after dressing, using either a hand stone or forming tool for all finishing cuts, regardless of wheel fineness. Very fine grinding, such as is required on cold strip rolls, often may be improved by taking a slight truing cut on the wheel sides for a distance of ¼ in. before rounding the edges.

Since crankshaft finishing usually is done by lapping, the quality of the grinding is a matter of dimensional rather than surface perfection. Therefore, the wheels may be dressed and trued satisfactorily with an abrasive wheel tool. It is, however, necessary to true the grinding wheel sides and radii with a diamond or abrasive stick.

In shops where high production of crankshafts is more important than tool costs, the diamond rather than the abrasive wheel dresser should be used, even for roughing cuts. Roughing cuts usually require only one truing with the diamond at a coarse feed and rapid traverse. The sides and radii of the wheel are trued when necessary. Finishing wheels call for more care and skill. The wheel sides are first trued to a gage with a sharp diamond. A dull diamond will produce a cutting surface that is apt to burn or check the crank side-walls. It is desirable to use a duller diamond on the wheel face, or to take a greater number of passes with a sharp diamond without feed in order to avoid dressing marks on the work. The diamond is passed across the face at a slow traverse, with about 0.001 in. feed. For "cutting back" to restore radii, it is economical to use a steel or abrasive wheel tool first and then finish with a diamond.

Keep Diamonds Cool

Cincinnati centerless grinders come equipped with truing fixtures for correctly truing and dressing both the grinding and regulating wheels. There are several points to keep in mind when using these fixtures due to the difference between centerless and center type grinding machines.

When dressing wheels for centerless grinders, it is not sufficient to depend upon the spray from the wheel for cooling the diamond. Keep a stream of water playing on the diamond. It sometimes is overlooked that the position of the diamond is the reverse of that in center-type grinders. It is set in back of the wheel. Therefore, to prevent the stone from gouging the wheel, it must be canted *upwards*, instead of down as in center-type machines.

Internal grinding wheels are usually dressed and trued with a diamond tool. However, the rough truing may be done with a silicon carbide dressing stick, and the final truing with a sharp diamond at a rapid traverse and light feed.

As an internal grinding wheel decreases in diameter through wear, the wheel action changes noticeably, due to the changed surface speed and arc of contact with the work. If a fixed diamond is adjusted to dress at the wheel center line, the wheel will be reduced the same distance from the center line of the workhead with no provision for compensating for the constantly changing wheel action. Therefore the position of the diamond must be changed constantly as the wheel gets smaller. This must be determined largely by trial as no set rule can be made to fit all conditions. Dressing on the center line will cause succeeding pieces of work to be ground smaller in the hole. On the other hand, if the dressing is too high or low, they will be ground larger. This is important in "Sizematic" and similar internal grinders. Unusual conditions should be taken up with the manufacturer of such machines in each case in order to get his recommendations.

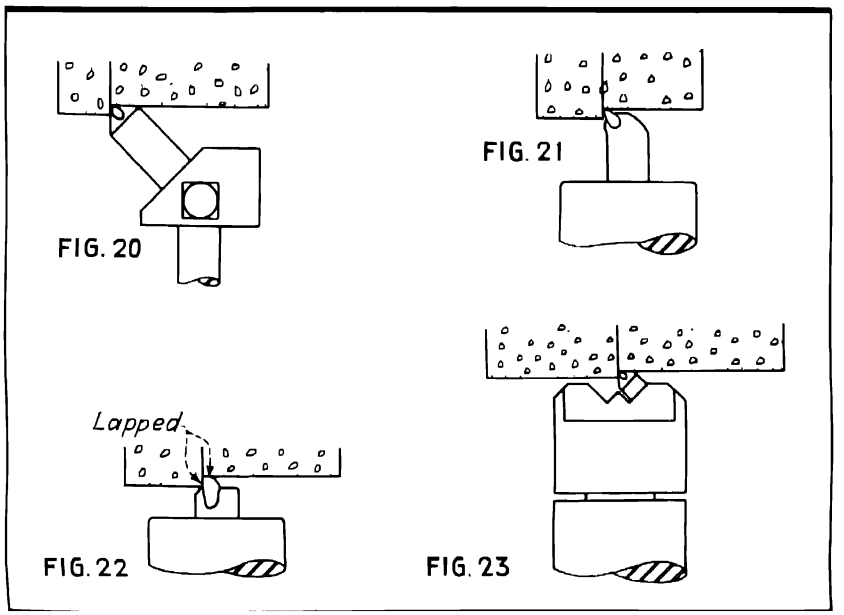


Fig. 20—A "drop" shaped, expensive diamond is needed in this type holder for truing sharp corners. Fig. 21—An ordinary stone can be mounted in an offset adapter for truing sharp corners. With this arrangement the diamond can be turned to provide sharp edges. Fig. 22—The diamond used in this set-up for truing sharp corners is lapped to shape. It can be used only so long as the lapped edges stand up. Fig. 23—This adapter permits setting the diamond in two positions

Rounded Threads

TO SECURE greater strength and longer fatigue life in threaded parts used in aviation engines and other fittings, the rounded top and bottom idea is being seriously discussed by the aircraft engine division of the SAE standards committee. Joseph Whitworth knew the advantages of the round top and bottom, but as it seemed unnecessary at that time, the flat top and bottom proposed by William Sellers was adopted.

This was a great improvement on the old V-thread and has been satisfactory for a great majority of work. It is easier to make than the round top and bottom and still has its place.

The demands for the utmost safety are likely to lead to the abolition of all corners in thread form for aircraft and similar uses. The radius will probably not conform to the Whitworth, but the idea is growing.

IDEAS FROM PRACTICAL MEN

Testing Alignment of Tailstock Spindles

By J. DAVIES

The alignment of the tailstock spindle with the live spindle should be checked, especially before undertaking reaming operations on a lathe. The pivoted two-piece alignment device *A* described by J. H. Moore (*AM*—Vol. 84, page 508), does not seem very practical for this purpose. For instance, if the head and tailstock centers were the same height but the tailstock a little off center laterally, and Mr. Moore's tool placed in the tailstock, as in Fig. 1, there would be no movement of the movable piece *B*, as shown by the dashed lines, since it can only move in one direction. To overcome this, the tool would have to be turned around in the tailstock to different positions. A suggested improvement is shown in Fig. 2; this consists of two pieces of stock turned exactly alike, one to fit the tailstock, and the other the headstock, with a sliding collar to pass over the parallel parts as suggested by Mr. Moore.

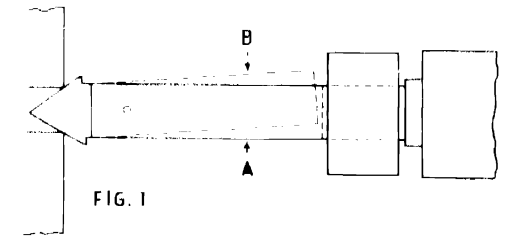


FIG. 1

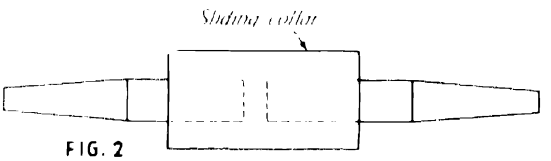


FIG. 2

The device in Fig. 1 for aligning lathe centers may not indicate centers out-of-line laterally but in alignment vertically, unless it is rotated. A suggested improvement is shown in Fig. 2

Finger Feed for Blanking Dies

By H. R. HAGEMAN

The finger feed for blanking dies, described by Henry W. Falstrom (*AM*—Vol. 84, page 664) hinges in the punch holder or punch plate, and drops back from its own weight during the upstroke of the punch. The drawing of the finger feed fails to show why the feed fitted for a 1½ in. stroke cannot be used in a press with a 2 in. stroke or greater.

It would seem that if a positive stop were placed in the punch plate so as to prevent the finger dropping too far backward, the punch holder with its assembled parts could be raised to any height and the feed would start functioning when it was lowered to its operating position.

If such is not the case, a description of a simpler type of finger feed which will operate in presses of various strokes can be found on page 13 of "Die Design and Diemaking Practice," Industrial Press.

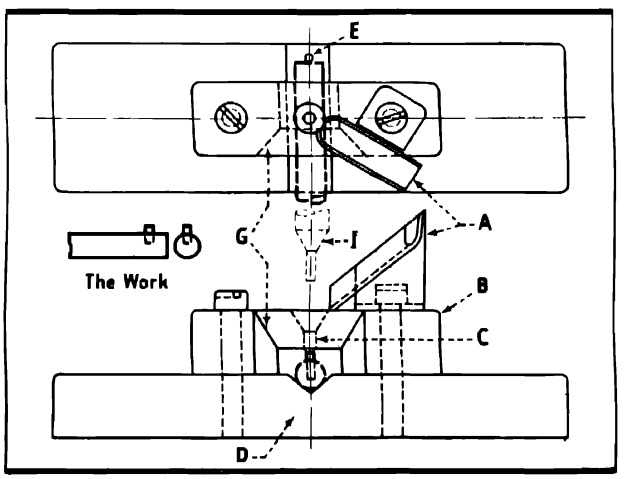
Rapid Assembly of Pins in Small Shafts

By GEORGE WILSON

The illustrated jig is used to assemble $\frac{1}{8}$ by $\frac{3}{8}$ in. pins in $\frac{5}{16}$ in. diameter shafts with a drive fit. The pins are sheared to length and are not finished on the ends. They are dropped into chute *A*, which is a straight sided trough having the same inside diameter as the mouth of the funnel in the guide block *B*, about $\frac{5}{16}$ in. The guide hole *C* is about 0.010 in. larger than the pin.

The operator places the rod in the V-block *D* with the pin end of the rod against the stop pin *E*. He locates the hole in the shaft, which is slightly chamfered, under that in the guide block by judgment; with a pin resting on the rod, it is quite easy to align the hole. To facilitate this, the guide block *D*, is bevelled away almost to the guide hole as at *G*. The pins slide into the guide block with no trouble from lodging crosswise.

To assemble these pins with a hammer and V-block,



This jig assembles $\frac{1}{8}$x$\frac{3}{8}$ in. pin in $\frac{5}{16}$ in. diameter shaft at a production rate of 750 pieces per hour

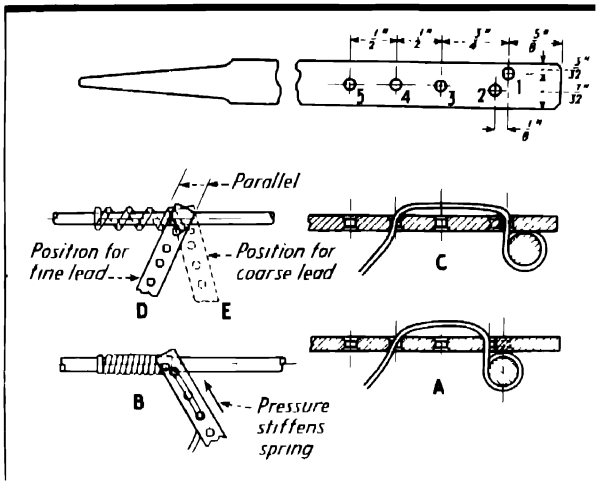
was found impractical, since the pins are too short to hold between the fingers. With this jig, it was not found possible to use any sort of aligning device for the holes in the work and fixture, that is, for aligning them circumferentially. But an operator can judge such alignment quite readily. Production with the jig is 750 pieces per hour.

Spring Winding Tool Controls Lead and Tension

By MAX O. HAAS

When winding a spring on a lathe arbor, it is often difficult to control the lead of the spring and the tension of the wire. The illustrated holder was designed to control these factors.

It consists of a flat piece of tool steel $\frac{3}{16}$ in. thick,



Open- or closed-coil springs can be wound on an arbor in a lathe with this tool, which is designed to control the tension of the wire and the lead of the spring over wide ranges

$\frac{1}{2}$ in. wide and 6 in. long; the tool shown is for wire smaller than $\frac{1}{8}$ in. One end is shaped to fit a file handle. The other end is left square and has five $\frac{1}{8}$-in. holes drilled through it; they are chamfered on both sides. Holes Nos. 1 and 2 nearest the end are for feeding the wire and governing the lead, while holes Nos. 3, 4 and 5 are for controlling the tension of the wire.

The diameter of the spring is determined by the size of the wire or arbor over which the spring is wound; however, by increasing the tension of the spring wire, a smaller size spring will result. The reverse is true if the tension is decreased. For low tension, feed the wire through hole No. 5 from underneath. Use hole No. 4 for lighter wire; for higher tension feed through holes Nos. 4 or 3. Then feed the wire down through holes Nos. 2 or 1 according to the kind of lead in the spring. For close winding, feed through hole No. 2. Very fine wire may have to be looped through three holes in order to build up enough tension.

When winding closed-coil springs, let the tool ride on top the already wound part as at *A* and hold it at an angle against the spring, as at *B*. Pressure against the arbor and parallel with the tool will determine the stiffness of the spring.

Open-coil springs are wound by letting the tool ride directly on the arbor against the last wound coil of the spring as at *C*. The finest lead is obtained by feeding the wire through hole No. 1. The next finest by using the tool upside down and feeding through hole No. 2. Using hole No. 2 from the other side or hole No. 1 upside down will give even greater leads. In between these the lead may be governed by the angle at which the tool is held as at *D* and *E*. With the tool held parallel with the coils, the lead will be smallest, while holding the tool at right angles with the arbor, or even beyond that, will increase the lead of the spring. Thus, one tool can be used for a variety of leads. The principle can be applied to all sizes of wire.

The wire is started by placing it in a hole drilled through the arbor and clamping it between the arbor and one of the chuck jaws.

Correct Layout for Second-Operation Dies

By A. D. MUNDY

One of the common mistakes which occur in laying out dies for second-operation work is the placing of the die on the die shoe parallel with the front of the shoe. Before laying out a die for this class of work, pick up the piece and try to place it in the nest *BB* as shown in Fig. 1; then try the same piece in the

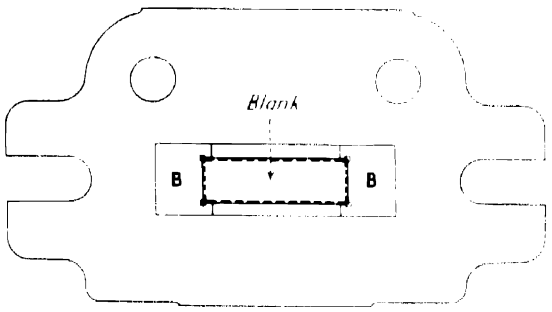


FIG. 1

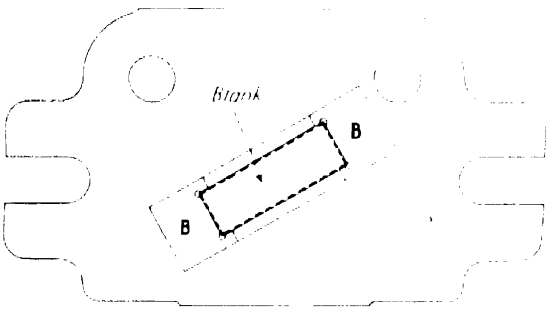


FIG. 2

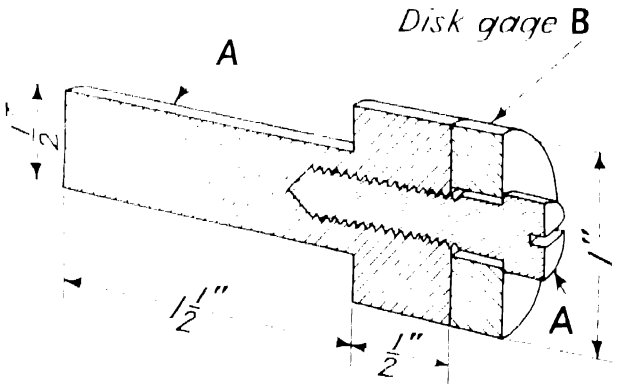
For convenient operation, second-operation die should be placed on the die shoe as shown in Fig. 2, instead of parallel with the front of the shoe as shown in Fig. 1

nest as shown in Fig. 2. It is obvious that Fig. 2 is much easier as it is so located that the operator's arm in its natural position falls in line with the nest. One of the best proofs of this is that after an operator has used a die laid out like Fig. 2, he will ask to have dies which are laid out like Fig. 1 set up at an angle on the bed plate of the press for more convenient handling of the work.

Drill Chuck Attachment for Spacing Holes

By EDWIN N. OLSON

Toolmakers are often required to drill accurately spaced holes on a drill press and while various methods are used I find that the illustrated drill chuck attachment is very useful. A piece of tool steel *A* is made to the dimensions shown in the drawing. The filister-head screw *A* must be a diameter smaller than



Holes can be spaced and drilled accurately with this drill-chuck attachment, which includes a disk gage held in place by a filister-head screw. After the first hole has been drilled, the next hole can be located with the aid of micrometers

the hole of the disk gage *B* so that the gage can be made to run true in the chuck. Toolmakers have access to micrometer disk gages which can be used for this purpose.

Assuming that the first hole has already been drilled we now proceed to make adjustments for other holes. After the chuck attachment has been made to run perfectly true in the drill chuck and filister screw has been tightened against gage, calculate the proper distance for the next hole, using micrometers. After all is set, affix job firmly to drill press table, center drill, drill and ream the hole.

This method will give surprisingly good results and will not be of the hit and miss type when trying to follow a layout or even heighth gage lines. There must be sufficient clearance between the screw and the hole in the disk gage so that disk will be allowed to "float" to its perfect running position. Using tool steel, this attachment can be hardened and be of service for many years.

Easily Loaded Hand-Milling Fixture

By F. SCRIBER

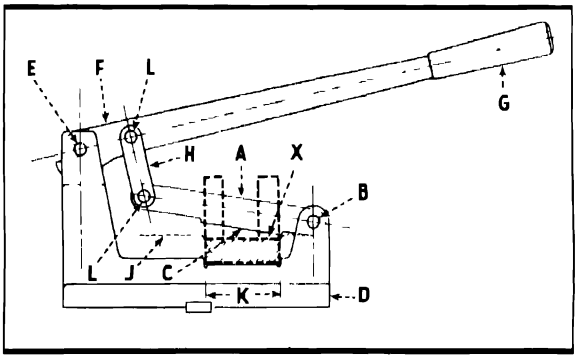
A hand-milling machine a fixture having a clamping feature that holds the work by hand while the milling operation is performed is illustrated. The clamping device is constructed so that the clamping units can be swung clear of the fixture while the work is put in place.

The work indicated at *X* has raised lugs at both ends while the central portion is rectangular as shown in section. The function of the clamp *A* is to pivot about pin *B* as a fulcrum and to bind the work by means of the finished portion *C* when the clamp is in the down position as shown by the dot and dash lines at *J*

The base *D* of the fixture is grooved to receive the work at *K*, and at *E* is a pin passing through two raised bosses having a space between them. An open-ended lever *F* hooks around this pin while the operator takes hold of the handle at *G*. Connecting the hand lever and the clamp *A* is a link *H* attached at *L* by means of two pins.

In the position shown, the operator holds down handle *G*, thereby bringing down clamp *A* and holding the work in place while he moves the table traversing lever of the hand-milling machine to make a light cut on the end of the work.

After completing the cut it is only necessary for



This clamping device for a hand-milling fixture permits the clamping unit to be swung clear of the fixture while the work is put in place

the operator to pull back hand lever *F* clear of the pin *E* when the entire clamping arrangement can be pulled back clear of the fixture, about pin *B* as a center, so that the work *X* may be removed without interference from any part of the fixture.

When the work is put in position on the fixture the hand lever is pushed forward to the left, thereby throwing the clamp over the work, while with the same action the handle is hooked under pin *E* so that pressing down on the handle clamps the work. It is necessary to hold the lever down to clamp the work during the entire time the milling cutter is in contact with the work; the leverage and recessed base holds the piece firmly during the short cut.

IT IS NO LONGER NEWS that the United States army has adopted a new shoulder arm, officially the U. S. 30R M1, but popularly known as the Garand after its toolmaker-inventor John C. Garand, a civilian employee of the Springfield Armory. What is news is that production of the weapons at Springfield Armory is proceeding satisfactorily with the objective of 1,000 a day early in 1941.

Thanks to Mr. Garand's years of painstaking development, the U. S. doughboy will be equipped with a rifle that has no bolt action requiring manual operation. He will be able to fire eight aimed shots without taking his eye off the target, and his average firing rate will be some 2½ times faster than with the old Springfield. All the soldier has to do is to squeeze the trigger for each shot since the rifle's action is semi-automatic. Its light recoil or "kick" is another feature that facilitates his aim.

The first Garands were literally hand-made. It took Mr. Garand and eighteen toolmakers about two years to turn out the initial lot of 80. Then larger quantities were manufactured on the Armory's old equipment that had formerly been used for making the Springfield rifle.

Since then great strides have been made in putting the rifle into mass production, both at the Armory and in plants of private manufacturers working under government orders. This story will show how the best thought of the Armory personnel, machine tool builders and small tool suppliers has gone into the 1,500 separate operations required to make a Garand rifle.

Only two years ago, Springfield Armory was struggling along with antiquated equipment. Few machines had been acquired since the World War, many were of Spanish-American War vintage and a few units dated back to Civil War days. An article published early last year (*AM*—Vol. 83, page 48a) showed that, at that time, three quarters of the equipment in Springfield Armory was over twenty years old.

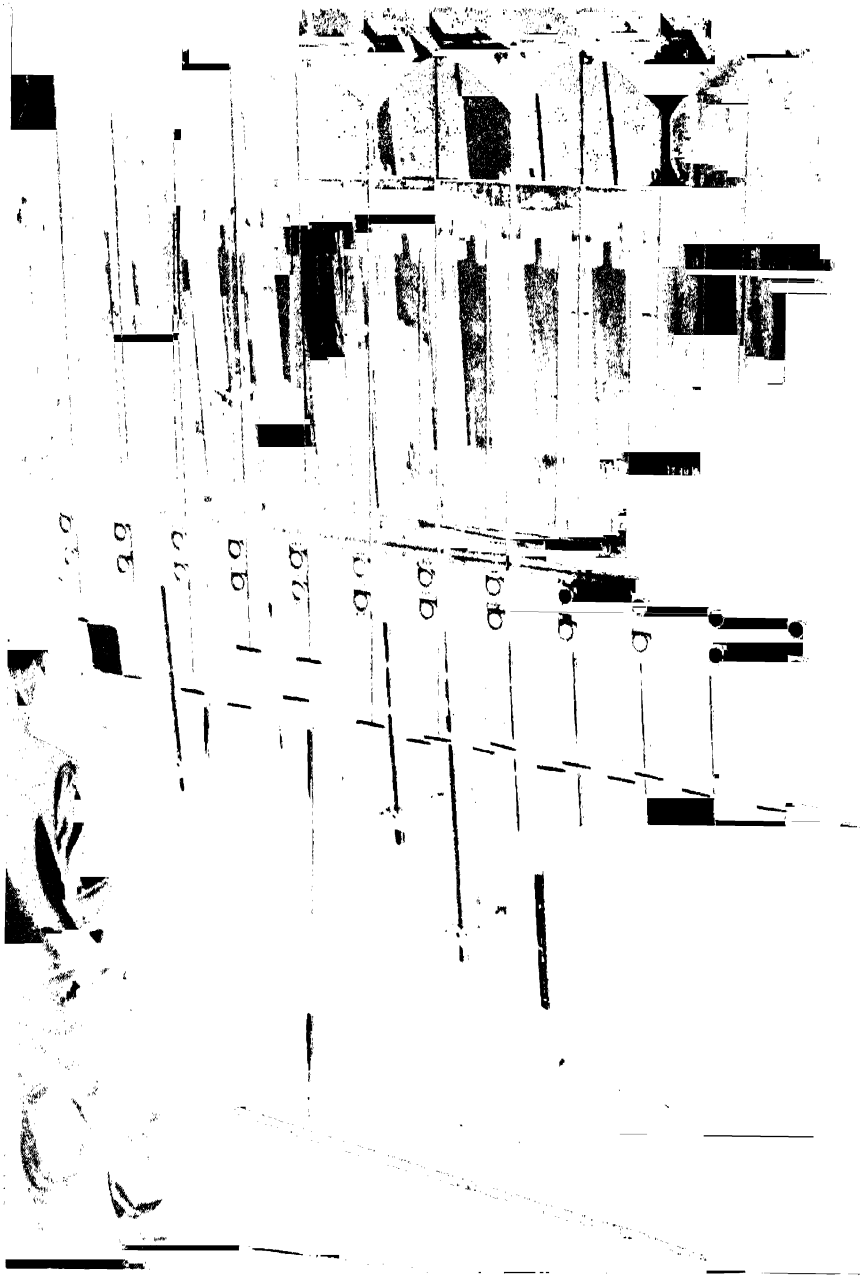
Today all this is changed. Modern machines hum away on Garand rifle parts using modern cutting tools, multiple cuts and the many other developments in mass production that the machine tool industry has been able to devise. In fact, the Armory has pioneered many methods in advance of those found in private practice.

For instance, its application of surface broaching to light parts is outstanding. It

100 GARANDS

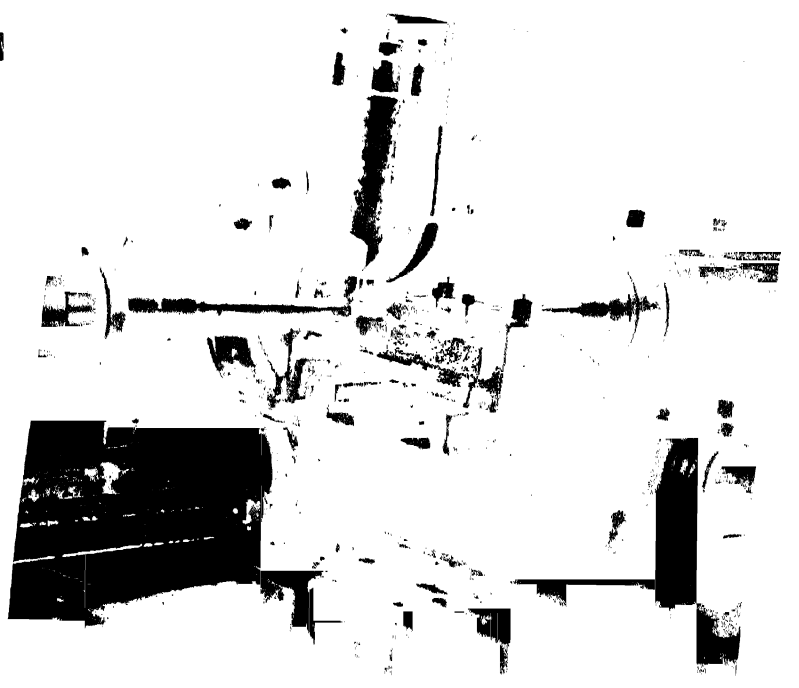
has also adopted drawn steel bars of special shape for many rifle parts, thus avoiding literally dozens of machining operations. It has utilized precision coining in the manufacture of certain components which were formerly machined all over at considerable expense. And it has applied the principles of progressive automatic die work to some of its sheet metal parts.

Probably no industry has been so steeped in tradition as that of rifle manufacture. The rifle is said to be the first product to use interchangeable manufacture; but having been the subject of this early advance in manufacturing technique, the old methods persisted until the current revolutionary changes were put to use. Until recently rifle parts

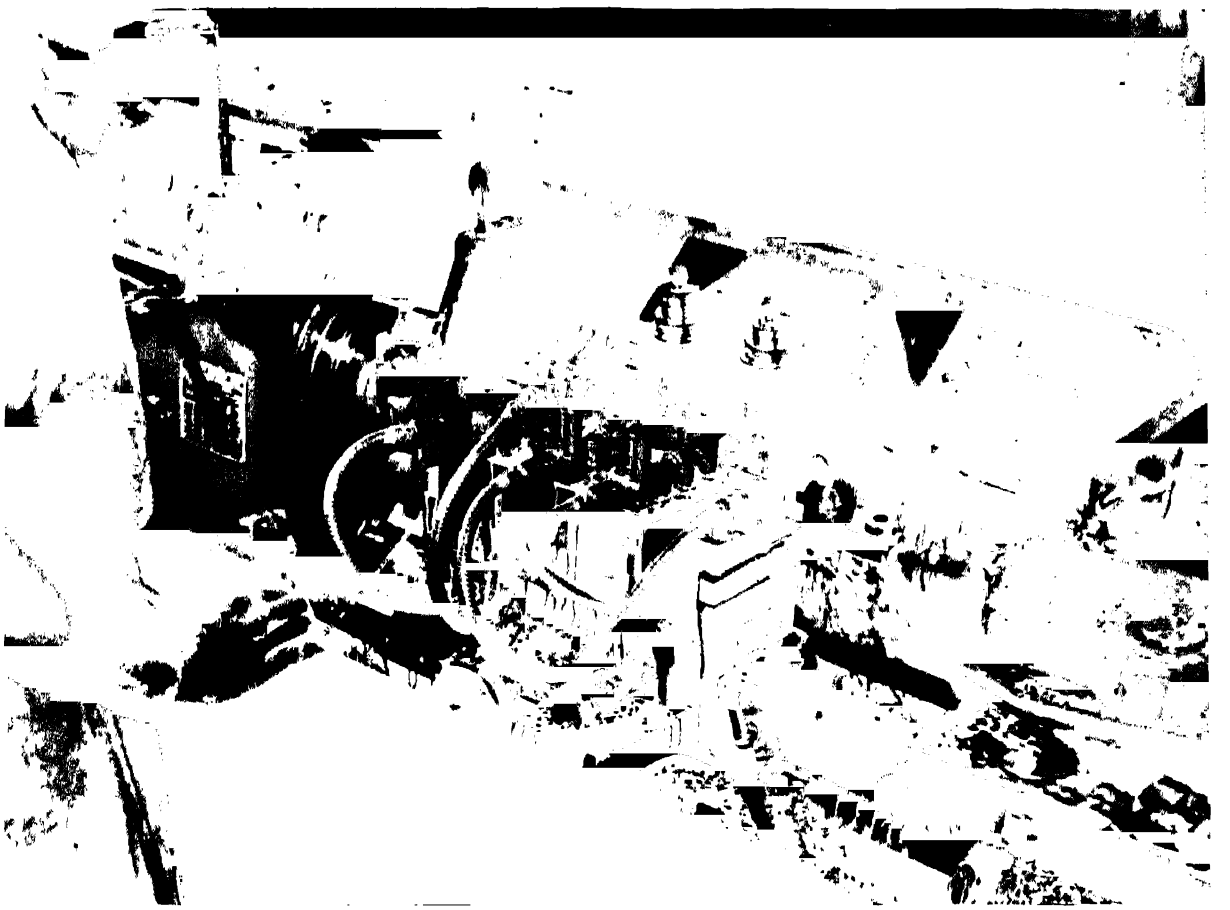


A Baush twelve-spindle special machine is used for rough reaming the bores. Each barrel is clamped in a slide and pulled upward hydraulically over the revolving tool. Each spindle is controlled independently by push-button

a I. Y



The barrel is finished turned on the taper section in a Speedcut lathe using a forming bar at the back of the machine to guide the tool. Note the heavy roller backrest to preserve wall thickness by preventing deflection during this cut



Rough operations on the Garand rifle barrel are performed in a Jay automatic lathe. Here five tools are taking a longitudinal cut at the front of the machine, while two tools are used on the backrest for shouldering and chamfering

practically without exception were made by a tedious succession of single machine cuts supplemented by hand operations. The contrast with present methods makes the new set-up all the more dramatic.

The Garand rifle has some 72 parts; since the machine operations on these parts range from 1 to over a 100, it would take a good-sized volume to describe them all in detail. In order to exemplify the methods employed, certain of the rifle parts have been selected for description; these reflect the wide variety of work used in rifle manufacture and show some of the methods developed at Springfield. The parts chosen for such description are the barrel, the rear sight base, the follower slide, the safety and the front hand guard ferrule.

The barrel is made from chromium-molybdenum steel (SAE 4150) heat-treated at the supplier's plant to 269-311 Brinell hardness. This steel is selected for good strength at moderately high temperatures; also even though of high strength, it has reasonably good machining properties.

OPERATION SHEET—Rifle Barrel. 1¼-in. dia. steel, SAE 4150

Grind spots for Brinell impression.

Make and record Brinell impression (269 to 311).

Cut to working length 24.200 — 0.010 in. and center ends.

Stamp stock mark on end of stock opposite Brinell mark; end with stock mark to be muzzle end.

Spin on rolls and straighten stock to max. runout 1/32 in. 3½ in. from end of barrel, opposite stock marked end, grind rest spot.

8 in. from end of barrel (opposite end to center rest spot) grind two roll rest spots.

Turn muzzle end 0.895 — 0.020 in. tapered to 1.00 - - 0.020 in. at end of cut shoulder of which is 6⅜ — ⅛ in. from breech end; chamfer muzzle.

Turn end opposite to stock mark to 1.355 — 0.01 in.; from ⅞ in. R. to 0.875 — 0.010 dia.; turn 0.875 — 0.010 dia. straight to 10.237 in. — 0.020 in. from breech end; chamfer breech end.

Spin on centers and straighten to max. runout of 1/64 in.

Inspect 100% (Magnaflux) (after rough turn operation for imperfections in stock construction).

Ream bore to 0.295 + 0.001 in. (Start reamer at breech).

C'sink both ends simultaneously 0.250 — 0.0075 over 0.375 in. ball in muzzle end, c'sink to end of barrel and 0.250 — 0.0075 over 0.375 in. ball in breech end, c'sink to end of barrel.

Spot grind, rest spot for back roll rest 9 3/16 in. from muzzle end.

Turn taper from 0.6751-0.005 in. muzzle end to 0.850-0.01 in. located 6⅛ — 1/16 in. from breech end (To remove surplus stock only).

Wash.

Line straighten bore.

Spot grind rest spot.

Turn major thread dia. rough (breech end) 0.985 — 0.005 in. square gage lenon shoulder and 0.975 — 0.003 in. dia. at 1.130 — 0.005 in. dia. shoulder; turn muzzle end 0.625 — 0.005 in dia.

Line straighten.

Spot grind muzzle end, rear of gas cyl. bearing 0.599 — 0.005 in. dia.

Turn taper sections from 0.637 — 0.005 in. dia. located 17.400 in. from breech end thread shoulder to 0.700 — 0.016 in. dia. at lower band bearing, and 0.770 — 0.005 in. at lower band bearing location up to and including ± ¼ in. radius.

Line straighten.

Turn muzzle end 0.540 — 0.005 in. and 0.5613 — 0.0054 in. major thread dia.; form groove.

Burr bore on muzzle and breech end of barrel to permit free entrance for centers.

Chamfer 30° angle on both sides of 9/16-32 P. thd. and form 45° angle on end of gas cyl. bearing.

Finish face gas cylinder lock seat and shoulder of thread.

Grind breech end to 1.115 — 0.001 in. dia. (rough).

Mill thread on breech end and lenon dia., topping nob to produce no larger than 0.972 in. major dia. of thread, 0.917 — 0.002 in. tenon dia., and 0.913 — 0.005 in. dia.

Form mill top (rough and finish) two at a time.

Wash.

Stamp stock mark and piecemark on stock.

Line straighten.

Grind lower band bearing 0.726 — 0.002 in. dia.

Mill rear hand guard grooves (R & L).

Ring straighten.

Spot grind 0.628 — 0.005 in. dia.

Grind muzzle end (finish) 0.514 — 0.002 in. dia.

Finish grind breech end 1.100 — 0.001 in. dia.

Grind 1 + ¼ in. radius.

Grind gas cylinder bearing 0.660 — 0.001 in. dia.

Mill three cuts for gas cylinder splines, symmetrical and concentric.

Ream chamber (rough) and c'sink breech end 45° to remove surplus stock on breech end of barrel.

Wash.

Rough and finish ramp including 0.01 R + 0.01 in.

Ream bore 0.298 + 0.001 in. dia. (Cut ream oper.) Start reamer at breech end.

Wash.

Ring straighten.

Ream bore (finish) 0.300 +0.001 in.

Wash.

Rifle bore (hook cut).

Ream chamber (finish) (Cut reamers only used).

Wash.

Broach lower band pin retaining slot.

Form 0.035 + 0.005 R at intersection of ramp and chamber.

Form 0.020 R + 0.005 in. at mouth of ramp.

Mill bullet nose clearance cuts.

Cut thread muzzle end.

C'sink, face and chamfer muzzle end of barrel to finished length 23.310 — 0.01 in.

Hone chamber.

Wash.

Mark manufacturer's initials, month of year and year of manufacture.

An operation sheet is given for the rifle barrel. It will be noted, that the number of steps is relatively great; this is because of the need at all times of maintaining a uniform wall thickness. The rough barrel forging weighs approximately eight pounds while the finished part weighs only 2½ pounds. As is well known, the removal of any great amount of metal from a long, slender piece of this kind tends to distort it. For this reason, frequent straightening operations are required so that when the next step it taken in machining, the wall thickness will remain uniform.

There are two general methods employed at Springfield Armory for inspecting and correcting bore straightness: the line method and the ring method. The line method is quicker but can be used only before the bore is rifled. The ring method can be used before or after rifling; it is somewhat slower, requires greater skill but is extremely accurate.

In the line method, the inspector holds the barrel in a screw jack and sights through the bore at a straight line scribed on a ground

This is the end of an Ex-Cell-O barrel rifling machine which controls the radial speed of the cutters. The cutter bar is rotated while a fixed socket holds stationary a nut at the end of the bar, thus setting up a tapered pin which pushes the cutters outward. The helical motion of the bars is controlled by precision guide screws at the opposite end of the machine





The top of the barrel is form milled in this double fixture using an equalizing clamp on a Brown & Sharpe milling machine

glass window some 20 ft. away. With his eye slightly above the center of the bore, he looks downward to see the reflection of this line in the bore's reamed surface. If the bore is straight, the line looks like two converging railroad tracks running about half the length of the barrel. A long curve indicates a gradual bend in the bore. A short kink indicates a sharp bend. The barrel is revolved and inspected from both the muzzle and the breech end. When the curves or kinks appear, they are removed by applying the jackscrew. Where to apply pressure and how much is a matter of experience.

In the ring test a painted glass cap, upon which a ring has been scribed to let the light through, is placed over the end of the bore. The light is reflected again and again to form a series of rings along half the length of the barrel, magnifying any irregularities. Out of roundness or lack of concentricity in the rings means that the bore is bowed or kinked. The barrel is rotated on rollers and inspected from both ends. Straightening is done with a copper hammer. Again the inspector has to learn where to hit and how hard.

Both line and ring tests have a high degree of accuracy and are repeated in the course of barrel manufacture to prevent variation in wall thickness. Otherwise a "walking" barrel will result; that is, the heating of the barrel when fired will result in uneven expansion, causing the barrel to "walk off" the target.

While many of the rifle barrel operations are familiar in machine shop practice, they represent a departure from older methods of making these parts. For instance, turning is now done on automatic lathes of the Fay type. In the first rough turning operation which takes cuts on the muzzle end, five turning tools are used at the front of the machine while two additional tools are used at the back for

1000 GARANDS DAY



Because of the fact that rifle reaming is a critical and delicate operation, the cutting edges of the tools must be lapped. These two fixtures, one for the outer radius and one for the cutter face are used to hold these tools while lapping



facing a shoulder and chamfering the muzzle. Cemented carbide tools have been found to speed production.

It will be noted, too, that after the barrel has been rough machined at both ends a 100 per cent Magnaflux inspection is used. The employment of this magnetic method of testing so early in the process shows up any flaws before a large amount of work has been done on the barrel.

More specialized are the operations for drilling, reaming and rifling the bore. For drilling a hollow, single-fluted drill is used which consists of a high-speed steel tip welded to formed seamless tubing. Coolant forced through the drill keeps down the temperature at the tip and washes the chips out of the bore. The barrel is rotated while the drill is fed from the breech end. Size is held to plus 0.0015 in.

Reaming is done in two steps. A newly designed vertical machine in which the tools are rotated while the barrels are fed upward over them, performs the rough reaming. This machine has twelve spindles each of which is independently push-button controlled. The feed is hydraulic.

After rough reaming, both ends of the barrel are countersunk to provide new centers. The depth of countersink is checked by measurement over $\frac{1}{8}$-in. steel balls.

Finish reaming and rifling are done in horizontal machines. For these operations particular attention is paid to tool sharpening. The reamer, for instance, is ground dry on a standard tool and cutter grinder with a grit wheel. Then without changing the set-up, a new extremely fine grit wheel with a shellac bond is used, to remove 0.001-in. of metal at the rate of 0.0002 in. per pass. The next step is to lap with oil and a fine lapping powder by hand using a piece of old gun barrel.

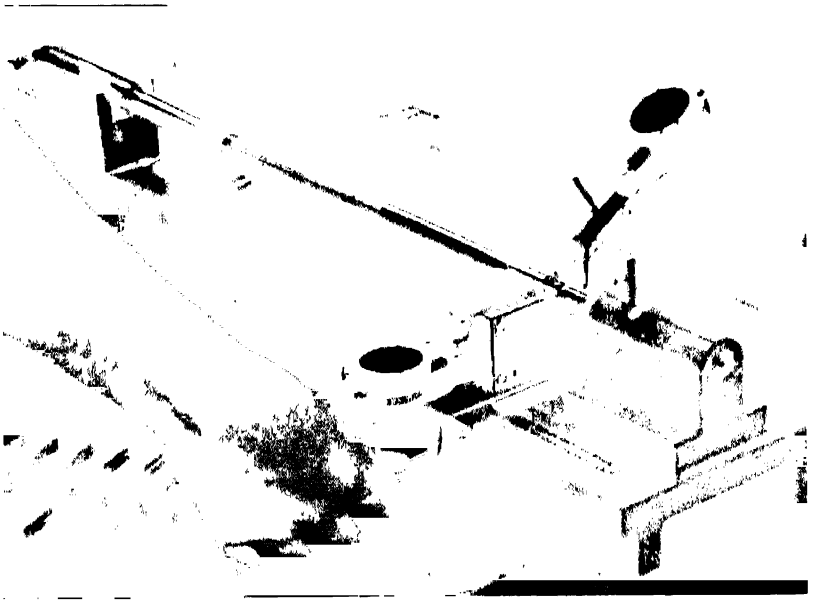
Finally the reamer is honed using triangular sticks of fine India or silicon carbide.

Hooked cutters are now used entirely for rifling at the Springfield Armory. These are somewhat sturdier and give increased production over the older feather-edged cutters. They must be accurately ground and stoned if they are to give the smoothly finished grooves which are so essential. These cutters are sharpened by a method closely paralleling that used for the reamer. For the hand honing operation, special fixtures are used. While held in a bar, such as used in the rifling machine, the cutters are rotated under the honing stone to give a smooth finish to the outside radius. A second fixture holds the cutter at the correct angle while the stone is worked back and forth to finish sharpen the face. Cutting angles are important.

Since rifling is done only in one direction, a special device is used to withdraw the cutters into the bar at the end of the cutting stroke. At the opposite end of the stroke, the cutter bar strikes a stop which again expands the cutters into operating position. In addition a nut at the end of the bar enters a recess which rotates a tapered plug to increase the depth of cut. This feed of the cutters is done at every other stroke of the rifling tool. The rifling grooves have a depth of 0.004 in. and a twist of one turn in ten inches or approximately two turns in the length of the barrel. Pratt & Whitney and Ex-Cell-O rifling machines are used.

Bore and grooves must be absolutely smooth and within a tolerance of 0.001 in. Dimensions of both are inspected at every inch along the length of the barrel by means of star gages. These gages have expanding fingers which give readings on a vernier micrometer at the end of a long rod. It has been found at Springfield Armory that it is advisable to add a spring to the star gage to give uniform pressure when expanding the measuring points, thus eliminating variations caused by the inspector's touch.

Another set of operations that calls for care is the chambering of the breech end. These operations are done in a machine with a vertical turret having a series of nine tools. Rough boring and reaming are done prior to the reaming of the bore while finish chamber reaming is done afterward. The reason for such care in these operations is that the surfaces so formed provide the bullet seat. Tolerances must be held close to seal the cartridge against the force of the explosive gases and at the same time to permit free



The size and position of gas cylinder splines must be held within close limits. They are checked on this fixture with two dial indicators. The one at the left connects with two expanding contact points which register the width of the groove while that at the right measures the depth

ejection of the bullet after the rifle is fired.

Jigs and fixtures have been devised on practically all the other operations on the Garand rifle barrel. They include devices for form milling the top of the barrel, straddle milling the rear hand guard slots, cutting the gas cylinder splines and milling the bullet nose clearance. Each of these fixtures has been designed to facilitate production by using multiple set-ups, quick-clamping arrangements or special indexing devices.

For form milling the top, barrels are set up two at a time in a fixture. They are supported in adjustable V-slots at either end and clamped by equalizing straps.

Roller toggles are used to clamp the barrel for milling the rear handguard slots. Here again a double fixture is used with the work held against V-blocks by means of pivoted clamps The clamping screws swing upward for quick release.

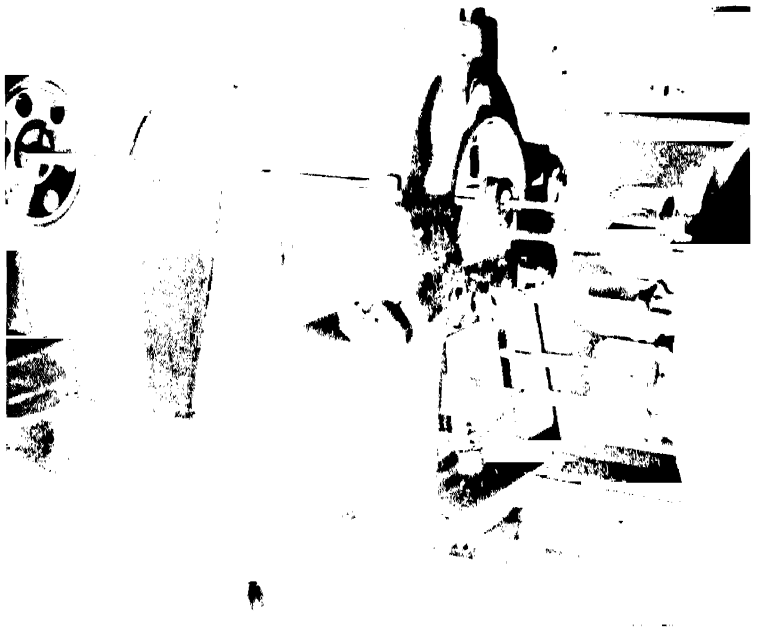
Each barrel has three gas-cylinder spline slots which must be accurate as to size and position. In a triple fixture, three barrels are indexed simultaneously by means of intermeshed gears and located by separate tapered lugs. The work is mounted on its centers.

To cut the bullet-nose clearance in the breech end, a special milling machine fixture is provided. By means of a rotary clamping sleeve, the work may be locked or rotated while the cut is in process. In this set-up the breech end is milled away for approximately 110-deg., and a small notch is cut in addition.

Naturally, cleanliness is essential to insure precision throughout the various operations performed on the barrel. It will be noted from the operation sheet that the barrel passes

Operations on the safety have been reduced from a multiplicity of milling and profiling operations to the simple sequence illustrated. Machining has given way to precision forging, coining, trimming and shaving



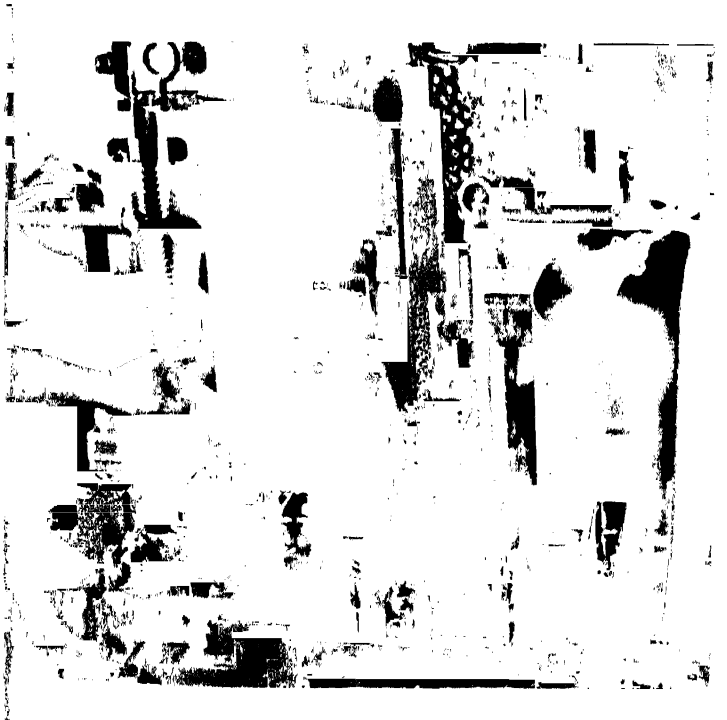


The barrel chamber consists of the surfaces that seat the cartridge, seal it against the force of explosion and still permit free ejection. It is machined in this multi-spindled Pratt & Whitney machine which cuts and reams a number of surfaces which must be accurate as to size and relative position

through numerous washings. In order to facilitate this process, a special set-up has been devised. The barrels are held in wooden racks 100 at a time. The rack is lifted and lowered by means of a hydraulic lift through four stations: loading, cleaning, rinsing and unloading. The cleaning and rinsing tanks contain soda solution and hot water respec tively. The hoist is located in the center of these stations and pivots as it lifts the work in and out of the tanks. Its use avoids manual handling of the barrel during this process.

Chief interest in the rifle part, known as the safety, centers in the fact that its method of manufacture has been entirely revolutionized. While this piece is small, its many irregular contours involve troublesome operations when the piece is machined all over. Formerly it was the practice to hollow-mill the 0.197 in. pin and then rough and finish mill practically all the other surfaces using both form milling and profiling. These steps required special fixtures for each operation.

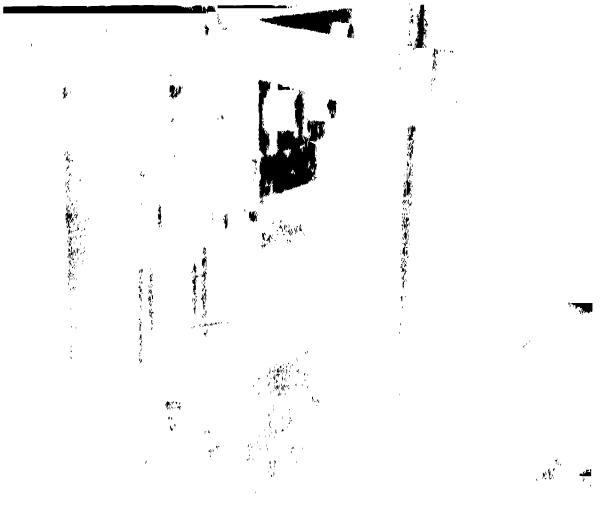
Now the safety is made without any machin-



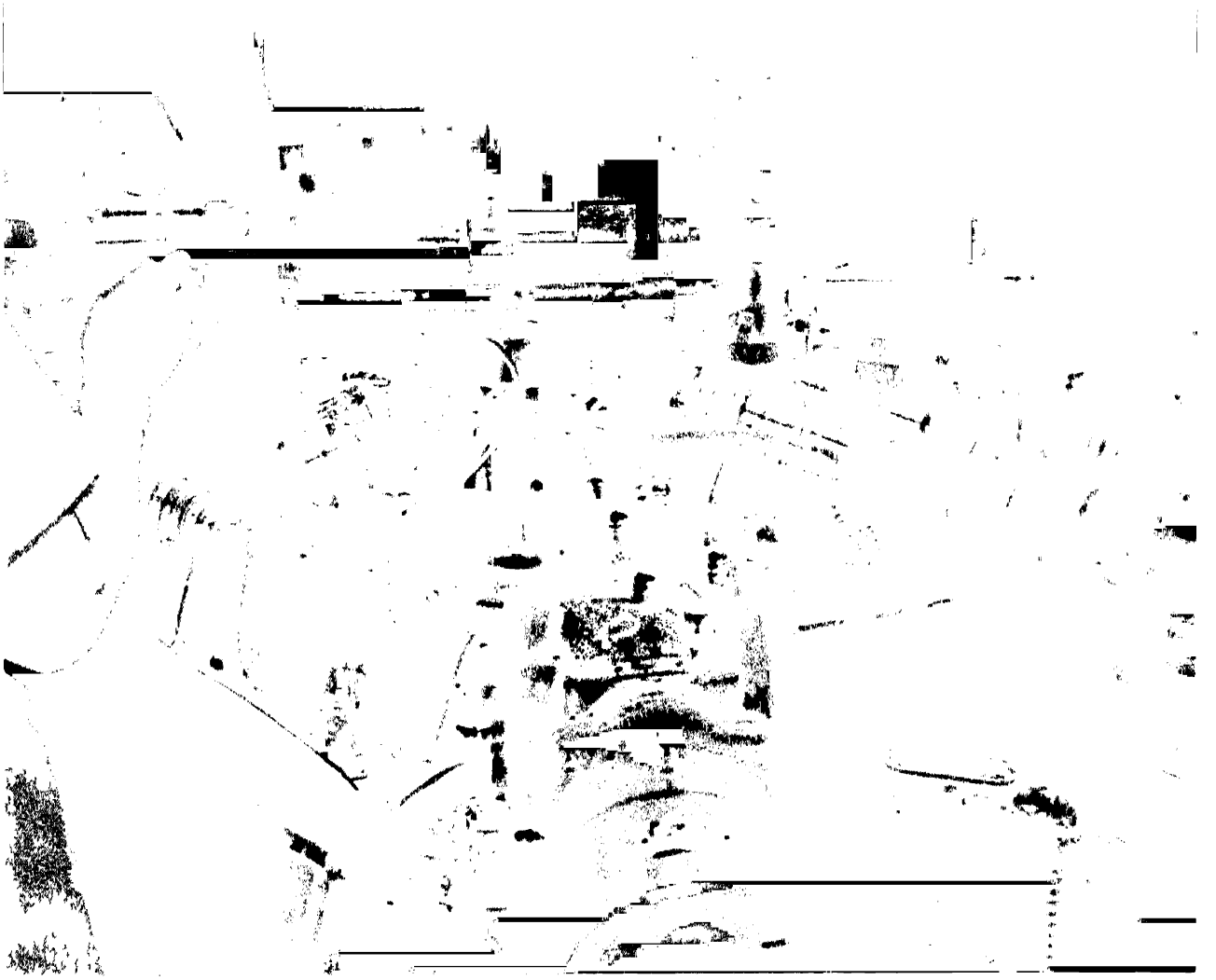
This set-up is typical of several broaching operations performed on the rear sight base. A two-ram Colonial machine is used with a pair of fixtures. That at the left trims the sides of the workpiece while that at the right cuts the radius and the under-cut

OPERATION SHEET—Base, Rear Sight. Steel forging, SAE X1340

Forge from bar at 1950 2200 F. Normalize at 1600 F. Cool in air.
Anneal at 1525 F. Adjust temp. to obtain Brinell 197-223.
Straighten and trim cold.
Broach both ends.
Broach both sides, and circular cut.
Broach bottom contour rough.
Broach top contour.
Broach sides at front end.
Drill, step ream, rough and finish hollow mill, rough tap and rough mill aperture slot.
Broach grooves and aperture slot.
Profile top and back between ears.
Profile top and back radius on ears.
Finish tap.



This is the trimming die used on the safety. The workpiece has already been forged to close limits before this operation is performed



The Kingsbury drilling machine used on the rear sight base has eight stations, two pieces are chucked in each fixture. The workpiece travels around twice being reversed after the first revolution. Auxiliary hydraulic work clamps are used at two stations where heavy cuts are taken (note overhead cylinders) because of the few surfaces available to grip the work securely. In addition to drilling, this machine roughs out the circular slot

ing operations. Instead of being forged to machining allowances, the part is made as a precision forging. A coining operation brings the piece to final thickness including the proper dimensions on the pin. Only three other steps are required, all press operations. The safety is punched to form two holes, trimmed in a die and then shaved to its final dimensions.

A step in the shaving punch used for the safety divides the shearing action, while a break-up pin cuts the surplus stock. As in other press operations, standard die sets are used wherever possible. The safety is made of a low carbon chrome-nickel steel, and is case-hardened after it leaves the press shop.

The rear sight base is selected as one of the riflle parts to which surface broaching has been effectively applied. This includes the new circular broaching which performs a difficult operation in a minimum time.

This piece is made from a free cutting medium carbon steel forging (SAE X1340). The base is odd in shape, involving as it does a number of irregular contours and circular grooves. At the same time, since it supports the rear sight, it must be machined to a high

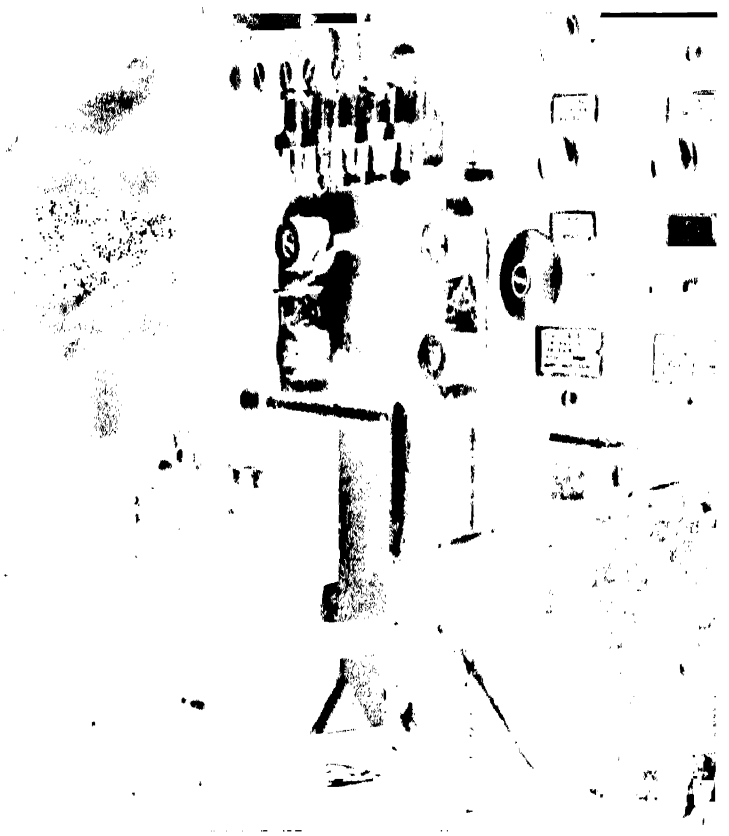
degree of accuracy. Were it not for the use of six broaching operations, each of which cuts a series of surfaces, the machining of this part would indeed be tedious.

One of the external broaching operations is illustrated. As in many rifle part operations, a double-ram machine is used with two fixtures. In this particular set-up, one set of broaching tools cuts the radius, under-cut and top surfaces while the second set of tools, shown at the right, broaches the sides. In each case the piece is held by a clamp in a positioning fixture, while the tools operate. One ram ascends while the other descends to take the cut. Other external broaching operations on this part follow the same general method.

Two additional operations on this part deserve special comment. A Kingsbury multi-station machine drills, reams, counterbores, trepans this piece and mills the slot. Because of the fact that this part is small and three sides of it have to be machined, there is very little area left for locating and clamping. For this reason it was found necessary to put on auxiliary air clamps at the stations where the trepanning or hollow milling operations are performed. The air cylinders for these two clamps are mounted on a cross-rail which reaches across the top of the indexing turret as shown in the illustration.

Each fixture is made to hold two parts as the parts are chucked twice. In this way, once all the fixtures are loaded, a completed part is obtained at each indexing of the turret.

The circular slot is only roughed out in the Kingsbury machine. It is made into a circular T-slot by the use of a circular broaching operation done on a Krueger machine. The circular broaching tool has a final cross-section corresponding to the finished dimensions of the slot. It has also a 54-deg. gap into which the work is inserted in order to start the cut. The fixture which holds the work is mounted on two slides. One of these allows the fixture to be moved to depth; a cross-slide is used to position the work relative to the center of the cutter. After the part is clamped, a push on the starting button causes the hydraulic circuit to advance the fixture against a stop. The cutter then rotates



This Krueger circular broaching machine performs a difficult operation in a minimum of time. One pass of the circular cutter undercuts the circular T-slot. After the piece is clamped in place, a touch on the starter button feeds the fixture forward hydraulically, holds it during the cutting cycle, and returns it to the loading position

through a complete revolution, and the fixture is backed away. The cycle is automatic. The cutter arbor is fitted with a micro-adjustable nut so the broach can be positioned vertically relative to the work-piece. The idea for this circular broach was worked out by Armory engineers with the builders of the equipment.

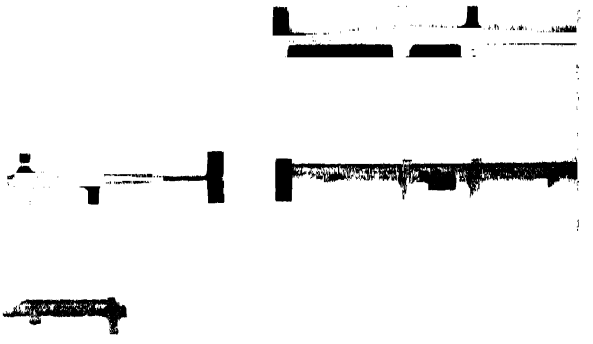
Two surfaces on the rear slide base which do not lend themselves to broaching are done by profiling. One of these steps is illustrated. The operation is to machine the radius which forms the top and back between the ears; at the same time the center mark by which the sight is set is cut in this surface. The cutter is made up of three parts; two circular cutters with a saw blade between them to mark the center. A working head follows a guide spindle in contact with a master cam of the correct contour in accordance with conventional profiling practice.

Another rifle component in which broaching plays an important part is the follower slide. But this piece has another point of interest in that it is made from cold-drawn chrome-nickel steel of special shape (SAE 3115). It will be noted that although the part is small, its many irregular surfaces would mean a multiplicity of operations if the piece had to be cut from rectangular stock. Many of these steps are eliminated by the use of the special cold drawn stock.

The illustration of the follower slide in



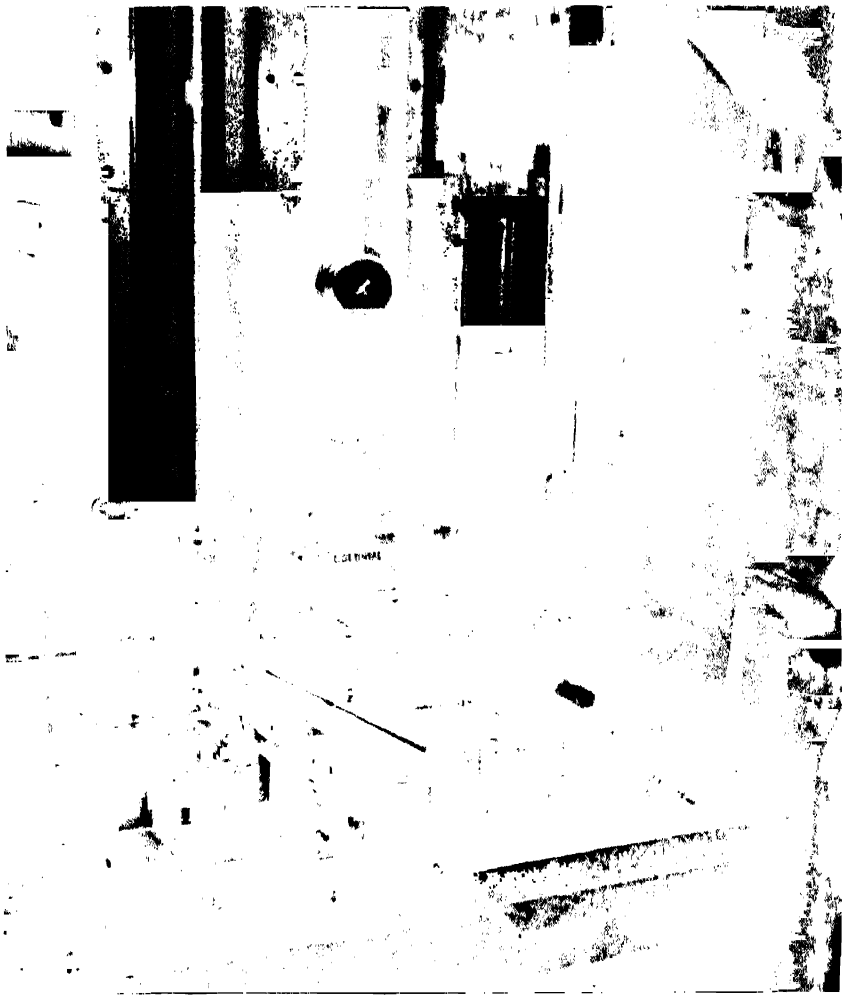
One of the two profile milling operations on the rear sight base is shown here. In this set-up the radius between the two side lugs is cut together with the saw mark for the central position. As usual in profiling, the cutter spindle follows a guide pin in contact with the master contour



The follower slide is one of several parts made economically by the use of drawn stock of special shape. Since the irregular contours are formed by the steel drawing die, the balance of the work can be done in comparatively few broaching and milling cuts. It will be noted that the piece as broached makes two of the follower slides

OPERATION SHEET
Slide, Follower.
Drawn steel, SAE 3115

Cut to length 4.962 — 0.010 in.
Strain relieve for one hr. at 800 F.
Blank both sides.
Inspect for straightness.
Broach one side.
Broach other side.
Broach bottom contour.
Mill 54 angle.
Form mill 20° angle.



A double-ram Colonial broaching machine does much of the work on the follower slide. This set-up uses a single fixture at the left and a double fixture at the right to cut surfaces in three directions

various stages of completion shows the main steps. After cutting to length by means of a rubber-bonded wheel, the stock is blanked, straightened and then broached, first on one side, then on the other and finally on the bottom. One of the broaching set-ups is shown. Here again a double-ram machine is employed using two fixtures which hold the parts; the ram on the right-hand side, carries two broaching tools for the two sides of the workpiece respectively. The fixture on this set-up has pivoted clamps operated by means of eccentrics. Each piece as broached is cut in half to make two components. The splitting is done when the 54-deg. angle is formed. Another milling machine operation cuts the 20-deg. angle which finishes the piece.

The fixture for this operation holds the follower slide while the flat 20-deg. surface and a radius are cut in it. When the upper part of the fixture strikes a stop held on the machine frame, it is forced along the base against the pressure of a spring. Meanwhile a rack acting through a pair of gears rotates the workholder to give the desired motion.

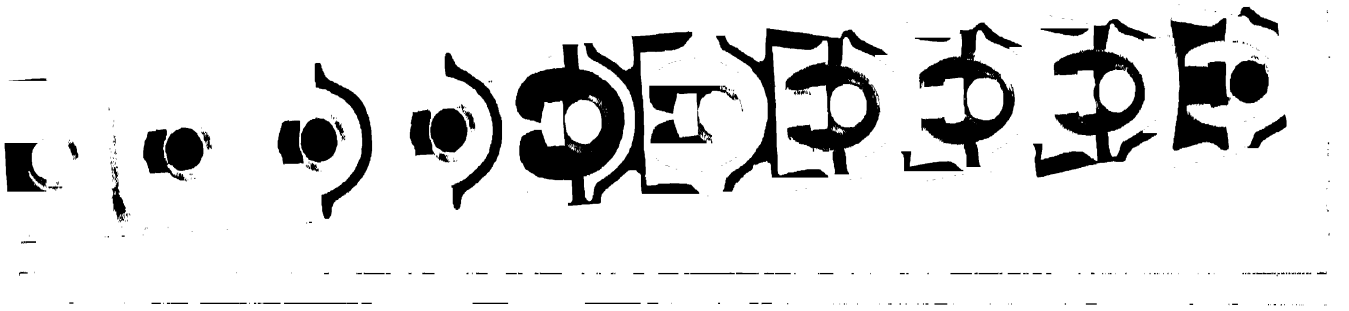
The front hand guard ferrule lends itself to progressive die work. The machine set-up as illustrated, together with a strip of the stock up to the point of shearing off, gives a very good idea of how this part is made. Although it is not part of the rifle proper, the cartridge clip is made by a similar set of tools in the same automatic dieing machine.

The operations as described above are typical of other manufacturing steps performed on other parts. For instance, special drawn



This is the Henry & Wright machine on which the front hand guard ferrule is made. A similar set-up is used for stamping out the cartridge clips

The front hand guard ferrule is made of strip steel stock in a continuous automatic dieing machine with the sequence of operations as shown. The use of this method eliminates the many separate steps that would otherwise be required



steel stock is used on the sear, the accelerator and the ejector. Coining is used on the trigger, the follower arm and the gas cylinder as well as the safety. The barrel, of course, is unique.

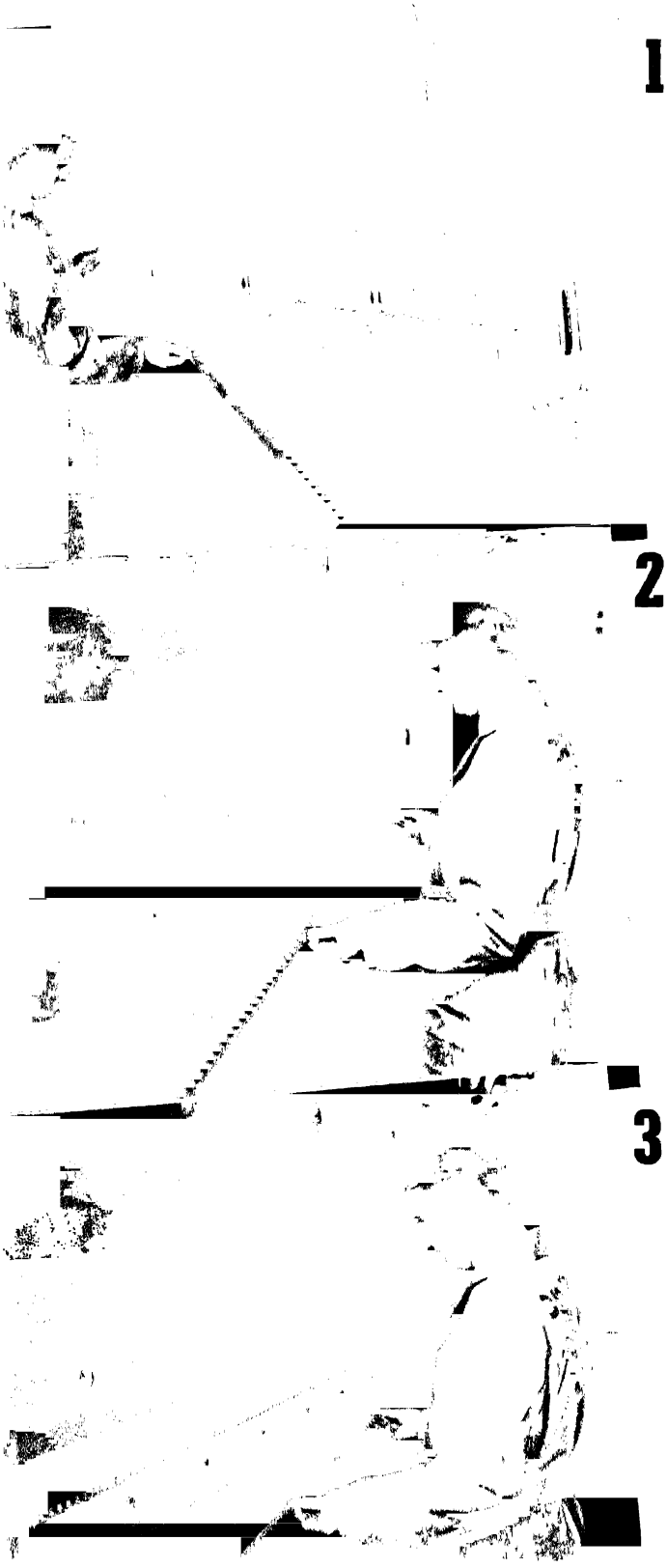
Nearly all the parts in the rifle are heat-treated, following final machining. The barrel is an exception having been heat-treated in the rough.

The parts are assembled to form the finished rifle. While hand operations are used almost entirely, the procedure has been improved and simplified so as to shorten the number of steps and length of time required to put a rifle together.

After inspection the rifle is tested. First it is given a proof test which consists of an overload charge subjecting the mechanism to about a 50 per cent greater pressure than it will receive from the standard cartridge. Then the rifle is given a functioning test of 64 rounds during which any malfunction is recorded, and if present, the rifle is sent back for disassembly, inspection and correction of the trouble.

Following this, the rifle goes to the ballistic division in which it is fired for accuracy. The rifle is held on a stand, and after three warming shots to heat up the barrel, it is fired at a target. At a distance of 100 yds. five shots must fall within a 3-in. radius in order to have the rifle pass inspection.

The final test of any weapon is how it stands up in the hands of the soldier in the field. Garand rifles are now rapidly being put into service. Experience received in this way is the only good method of proving the merits of this weapon.



WITH PROPER TOOLS, only six operations are necessary to produce both strips needed for a piano-type continuous hinge such as now is finding considerable application in aircraft construction. Some airplane builders are making these hinges of aluminum alloy, others use stainless steel. For the hinges shown in the accompanying illustration, the dimensions are the same for each material: thickness, 0.045 in.; length of hinges, 6 ft.

Each complete hinge consists of two loop-tongued and notched blanks. The tongues are 15/32 in. wide and the mating notches are 17/32 in. wide. In the finished hinge, the tongue loops are joined continuously with a 0.090 in. diameter pin. These hinges are made in four widths (when both strips are joined): 1-1/16 in., 1¼ in., 1½ in., and 2 in.

Only three press brake operations are required to produce each strip:

1. Notching the blank in one stroke produces the tongues.

2. The ends of the tongues are formed or coined in one stroke.

3. Curving the coined ends of the tongues in one stroke completes the loops.

The notching equipment for the first operation is shown in Fig. 1. Here, the top die consists of individual cutting punches, mounted in a bolster plate. The bottom die, in addition to mating die sections, has adjustable gages for the different widths of material, and finger strippers to remove the work from the dies. Outlets in the bolster plate upon which the die plate is mounted permit the slugs to drop through at the rear of the press brake.

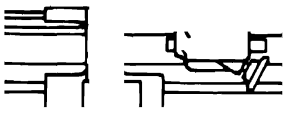
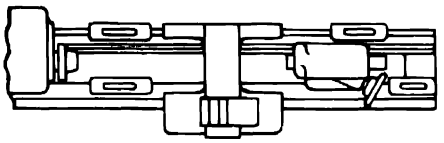
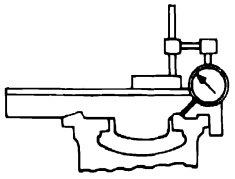
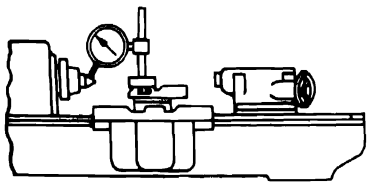
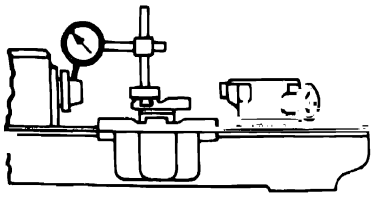
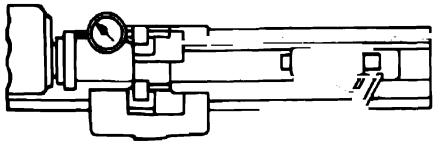
The forming equipment for coining the ends of the tongues in the second operation is shown in Fig. 2. The lower die in this set-up has interchangeable adjustable gages for the different widths.

The final looping operation on the strip is shown on Fig. 3. Here, the coined ends of the tongues are curved to complete loops in one stroke of the brake. Here again simple gages are provided for handling the different widths of strip stock.

Standards of Accuracy for Engine Lathes—I

Courtesy of the National Machine Tool Builders' Association

THE FOLLOWING standards of accuracy were drawn up and adopted by the builders of engine lathes, members of the National Machine Tool Builders' Association. The standards give tolerances to which the industry is building toolroom and engine lathes, and tests by which the tolerances may be checked. *(To be continued)*

TEST	RECOMMENDED STANDARDS		
	Toolroom lathes	12 to 18 in engine lathes	20 to 36 in engine lathes
 *Bed level, transverse direction*	When using precision level, both readings to be within 0.0005 in. in 12 in.	When using precision level both readings to be within 0.0005 in. in 12 in.	When using precision level, both readings to be within 0.001 in. in 12 in.
 *Bed level, longitudinal direction*	When using precision level along bed, maximum reading to be within 0.0005 in. in 12 in.	When using precision level along bed, maximum reading to be within 0.0005 in. in 12 in.	When using precision level along bed, maximum reading to be within 0.001 in. in 12 in.
 *Tailstock way alignment*	Maximum reading along length of bed, 0.0005 in. in 18 in.	Maximum reading along length of bed 0.00075 in. in 18 in.	Maximum reading along length of bed, 0.001 in. in 48 in.
 *Spindle center run-out*	Total indicator reading, 0 to 0.0001 in.	Total indicator reading, 0 to 0.0005 in.	Total indicator reading, 0 to 0.00075 in.
 *Spindle nose run out*	Total indicator reading, 0 to 0.0003 in.	Total indicator reading, 0 to 0.0004 in.	Total indicator reading, 0 to 0.0006 in.
 *Cam action of spindle*	Total indicator reading with indicator on rear side of test plate, 0 to 0.0003 in.	Total indicator reading with indicator on rear side of test plate, 0 to 0.0005 in.	Total indicator reading with indicator on rear side of test plate, 0 to 0.00075 in.



PREPARE!



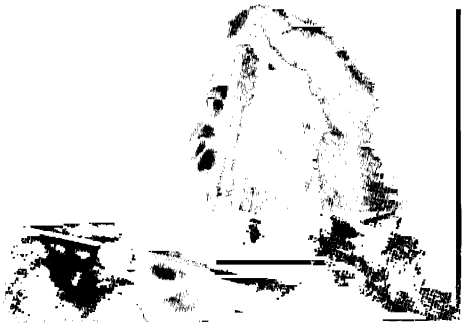
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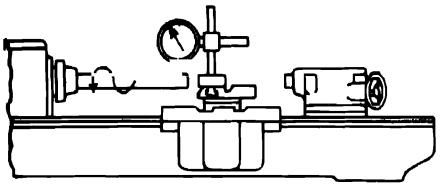
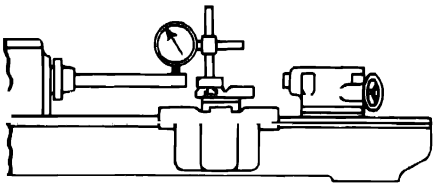
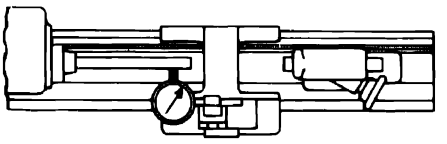
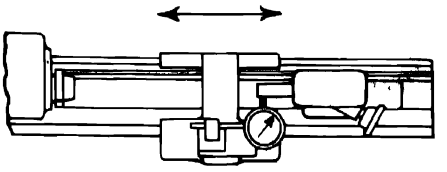
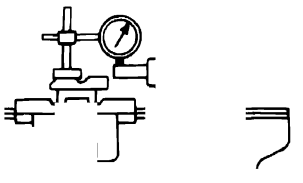
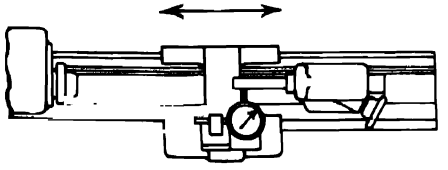


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Standards of Accuracy for Engine Lathes—I

TEST	RECOMMENDED STANDARDS		
	Toolroom lathes	12 to 18 in. engine lathes	20 to 36 in. engine lathes
 *Spindle taper run-out*	Total indicator reading at end of 12-in. test bar, 0 to 0.0006 in ; at end of spindle nose, 0 to 0.0003	Total indicator reading at end of 12-in. test bar, 0 to 0.0008 in ; at end of spindle nose, 0 to 0.0001	Total indicator reading at end of 12-in. test bar, 0 to 0.00125 in.; at end of spindle nose, 0 to 0.0006
 *Headstock alignment, vertical*	High at end of 12-in. test bar, 0 to 0.0005 in.	High at end of 12-in. test bar, 0 to 0.0001 in.	High at end of 12-in. test bar, 0 to 0.001 in
 *Headstock alignment, horizontal*	At end of 12-in. test bar, 0 to ±0.0003 in	At end of 12-in. test bar, 0 to ±0.0005 in	At end of 12-in. test bar, 0 to ±0.0008 in.
 *Tailstock spindle alignment, horizontal*	Forward at end of spindle when fully extended, 0 to 0.0005 in.	Forward at end of spindle when fully extended, 0 to 0.0005 in	Forward at end of spindle when fully extended 0 to 0.0005 in.
 *Tailstock spindle alignment, vertical*	High at end of spindle when fully extended, 0 to 0.0005 in	High at end of spindle when fully extended, 0 to 0.0008 in.	High at end of spindle when fully extended, 0 to 0.0015 in.
 *Tailstock taper alignment, horizontal*	End of 12-in. test bar, 0 to ±0.0005 in.	End of 12-in. test bar, 0 to ±0.0008 in.	End of 12-in. test bar, 0 to ±0.0015 in.

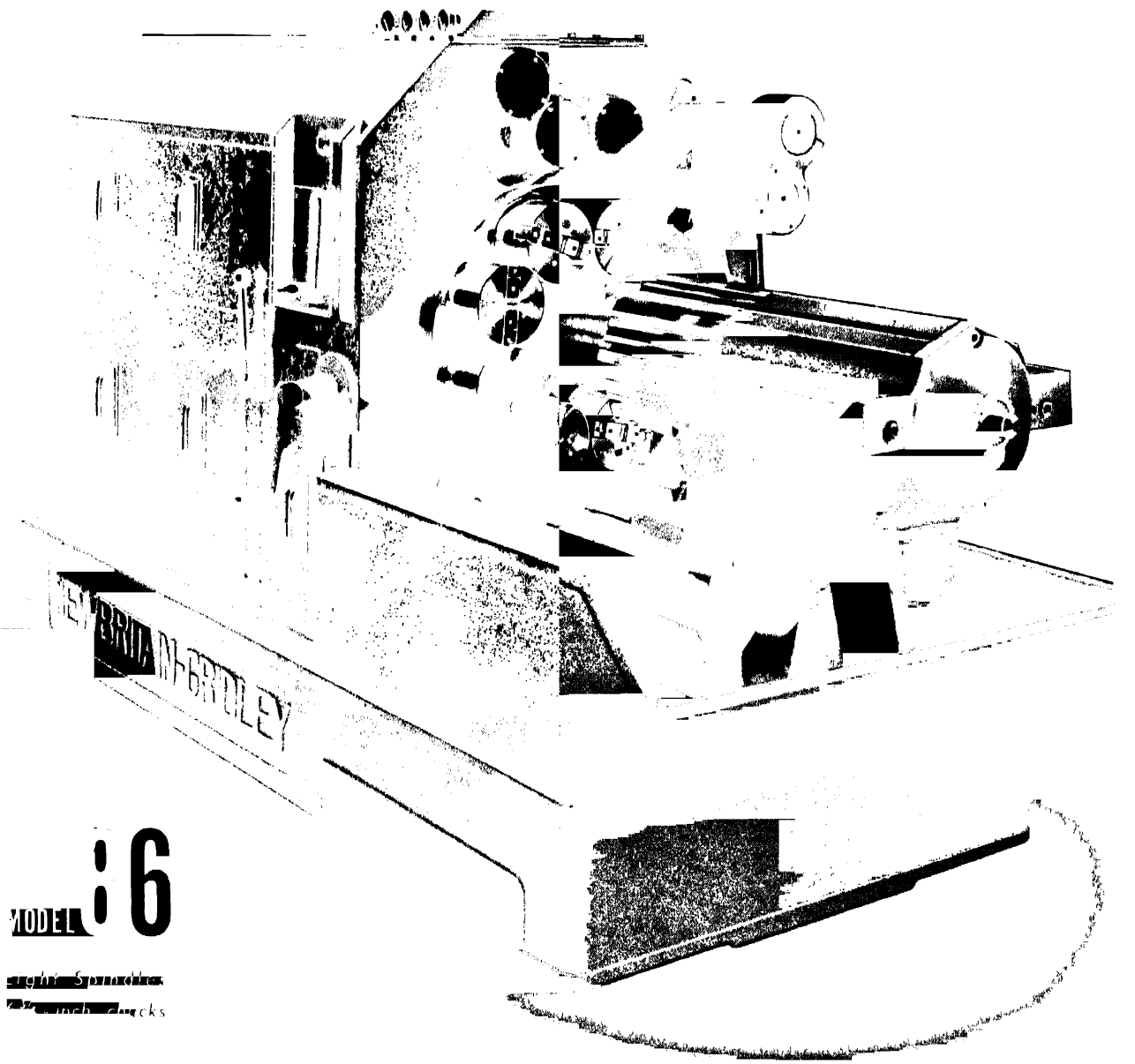
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Subcontracting Speeds Defense

UNCLE SAM has cut out for himself the biggest peacetime job in his career. He intends to raise, train and equip an army of 1,200,000 men and to have on hand the equipment for an additional 800,000 men by April 1, 1942.

That date sounds like a long way off, but actually it is less than seventeen months distant. To start from scratch to produce such a huge supply of armaments by then—airplanes, ships, tanks, guns, shell—is a task to make the most efficient shop leader cross his fingers hoping there will be no slip-up.

To do that task as quickly as possible is the program immediately ahead of industry. If the time schedule is to be met, it appears to us that two courses are necessary

First, new plants and new production lines must be created and equipped without delay. But to say "without delay" doesn't mean it can be done next week or next month. By the nature of mass production, tooling up is a tedious and painful process. He who expects to see automobiles come off the lines today and tanks tomorrow is profoundly ignorant of mass production industries. As Alfred P. Sloan, Jr., has said, "At the best a year is needed between the inception of a defense project and production, months more to develop the maximum capacity and efficiency."

Though nothing can stop the United States from out-producing everybody else in the world in short order after things start rolling, there is no reason to sit and twiddle our thumbs while we watch the new plants going up and the new machinery being installed. That brings us to the second course to be followed in the speeding up of our program for armament manufacture.

The subcontracting system, the method of farming out just as much work as possible, should be utilized to the fullest extent. Parts production can be distributed through the community and the district and the nation.

In this manner idle or partially active plant capacity can immediately be put to maximum use. Machine tool and other factory equipment already in place can be put to work. More people will be employed, payrolls will be spread wider and economic stimulation will be more greatly diffused.

Some people in Washington figured that in a national emergency the thing to do would be physically to transfer machinery from an idle plant to another company straining to get out more production than its capacity could handle. How much more sensible, and how much less dislocation will occur, if the machinery stays where it is and the idle plant is given a subcontract. The same purpose will be accomplished more rapidly and more efficiently.

Subcontracting defense work on a big scale already has proved its worth. It has been tried successfully in the aircraft industry; Boeing employs 360 subcontractors in making the Flying Fortress. It has been tried successfully in the machine tool industry; one company alone has 72 outside shops working for it.

The subcontracting system isn't a cure-all for defense delays. But it is a relatively simple and effective way of putting men and machines to work for Uncle Sam with the least delay when minutes and hours and days are precious. Let's use it to the greatest possible extent.

Burnham Finney

GAGING BUSINESS

Machine tool production is double that of year ago. Expansion of plant capacity is large. Big awards are made of ammunition components. Steel consumers reported laying in more tonnage.

Tooling of existing metal-working plants and construction of new factories to expedite manufacture of armament for the U. S. defense program are proceeding at a record pace. Meanwhile production is being quickened and employment increased as the Army and Navy place orders of unprecedented peacetime size and as the subcontracting work on munitions orders spreads activities widely throughout the metal-working field.

Machine Tools—The machine tool industry is making extraordinary efforts to speed up production. Already output is twice that of a year ago. Operations now are on a basis closely approaching $500,000,000 a year, or five times the annual business normally handled. Expansion of plant capacity is much greater than supposed. Today factories are 50 per cent larger than in November, 1939, and construction of plant additions still is going forward. In one machine tool center alone, six companies have just completed or are in the process of erecting additions. In several cases machine tool builders have enlarged floor space materially two or three times since the war started. Most of the expansion has been privately financed, though government money is involved in a few instances. Steps have been taken in Washington to clarify preference ratings on defense orders most of which have been designated as A-1 work. Formation of the Machine Tool Priorities Advisory Committee insures that essential machine tool orders for non-defense industries will get priority ratings and that British deliveries will not suffer.

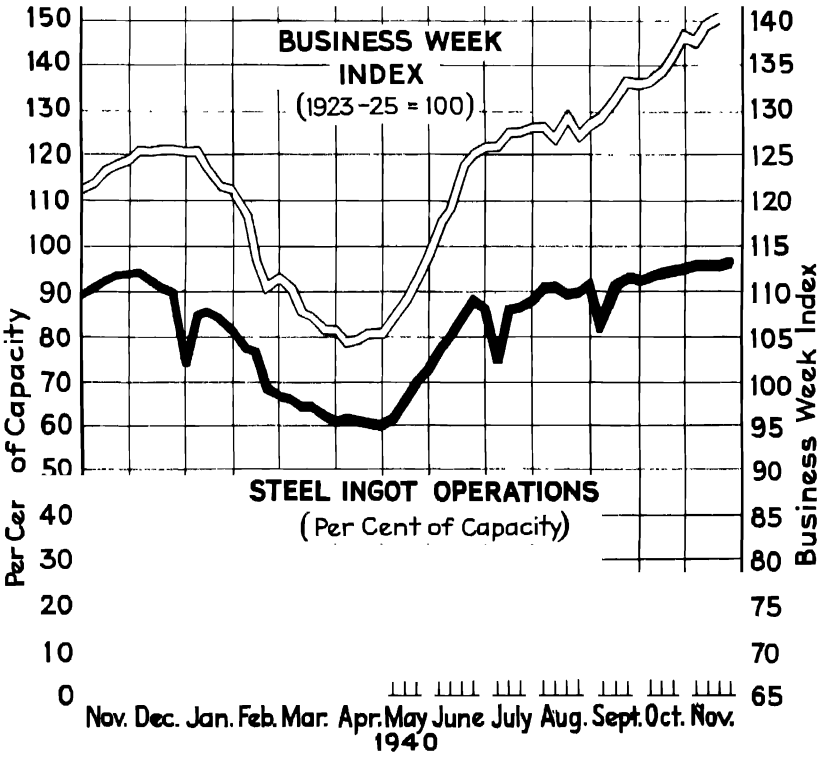
Munitions—The War Department continues to make big awards of contracts for ammunition components and for artillery and small arms ammunition. Orders for $20,299,459 for loading artillery ammunition have gone to three government-owned plants now being built at Wilmington, Ill., Ravenna, Ohio, and Burlington, Iowa. One of the largest defense orders placed in the middle west is for $7,614,630 of ammunition components to be supplied by Ingersoll Steel and Disc Division of Borg-Warner. Borg-Warner now has about $14,200,000 of defense business, of which $4,600,000 covers subcontracts. It also is negotiating for new contracts that may exceed $10,000,000. Kelsey-Hayes at Detroit, reported making 50-mm. machine guns for the British, is said to have been urged by the British to double its capacity.

Steel—The rush of steel buying has been further intensified. This is believed due to a desire on the part of consumers to build up larger stocks in anticipation of a possible imposition of priorities on defense orders. Mill operations continue close to the industry's theoretical capacity, and no change is looked for. Actual consumption is above 90 per cent, despite users' efforts to add to inventories.

Aircraft Airplane engine production is being accelerated by all three major builders. Allison turned out 286 liquid-cooled engines in October, compared with 223 in September and 65 in August. The new buildings at Allison will be ready in January and all machinery for a big expansion program will be installed by next September. A year from now output is expected to be 1,000 engines a month. The new Lockland, Ohio, plant of Wright Aeronautical Corp., where Wright engines will be built, will be operated on a two-shift basis 10 hours to a shift, six days a week, according to present plans. The Navy has placed two airplane orders totaling $93,842,500 with Consolidated Aircraft. Work has begun on the new $11,243,000 Curtiss-Wright airplane factory at St. Louis.

Farm Equipment—Manufacture this year has about reached the volume of the peak years 1936 and 1937. Exports the first nines months of 1940 were $61,800,000, or not far from last year's total of $68,094,306. Thus far the industry has received only $12,000,000 of defense orders about half of which is for tractors.

Railway Equipment—The year's total bookings are estimated at 445 steam and diesel electric locomotives, 57,000 freight cars and possibly 300 passenger cars. If these figures are attained, 1940 will prove the biggest year since 1929 with the exception of 1936 when a rush of business in the final month shoved up the total to 536 locomotives and 67,544 freight cars. Outstanding inquiries amount to 6,000 to 7,000 freight cars.



DISTRIBUTION OF U.S. CONTRACTS

WASHINGTON—Of $7,616,650,000 which has been spent for defense up to November 1, more than $2,000,000,000 went to concerns in New York, New Jersey, and Pennsylvania A geographical distribution of the contracts awarded, not including subcontracts, is as follows

New England, $1 322 478,000,
Middle Atlantic, $2 090,227,000,
North Central, $1,013,699,000,
South Central, $332 655,000,
South Atlantic, $1,171,197,000,
Pacific Mountain, $1 396 000,000
Territories, $1 463,157, and **Unassigned,** $210 141 000

Create Machine Tool Priorities Board to Speed Defense Orders

WASHINGTON — A Machine Tool Priorities Advisory Committee has been created to insure against delay on essential orders for machine tools for non-defense industries and for the British Mason Britton is chairman of the committee Other members are Frederick V Geier president National Machine Tool Builders' Association, Clayton R Burt chairman Defense Committee of the association, Lt-Col A B Johnson representing the Army, and Com Henning representing the Navy

The new committee is subordinate to the Knudsen-Stettinius-Henderson Priorities Board It can act only in an advisory capacity, but if its recommendations are accepted by the Priorities Board they become law The committee's relationship to the Army and Navy Munitions Board's Priorities Committee has not yet been decided

Thus far non-defense commercial orders for machine tools and British orders have had no priorities ratings Builders have been able to slip into their schedules a certain number of non-defense orders and at the same time meet the specified delivery dates on munitions orders, but that condition will not continue as business from munitions makers greatly increases Priority rating should be given an order from an airline for machine tools for maintenance purposes Determination of policies governing ratings and their relationship to munitions priority ratings will be decided by the new committee

Though the British orders have had no preference ratings, word went out from Washington to machine tool builders that these orders were not to lose their positions on production schedules because of new defense business The Machine Tool Priorities Advisory Committee now has the job of giving British orders an official status on the priority list

U.S. Takes Steps to End Confusion Among Machine Tool Builders on Priority Ratings

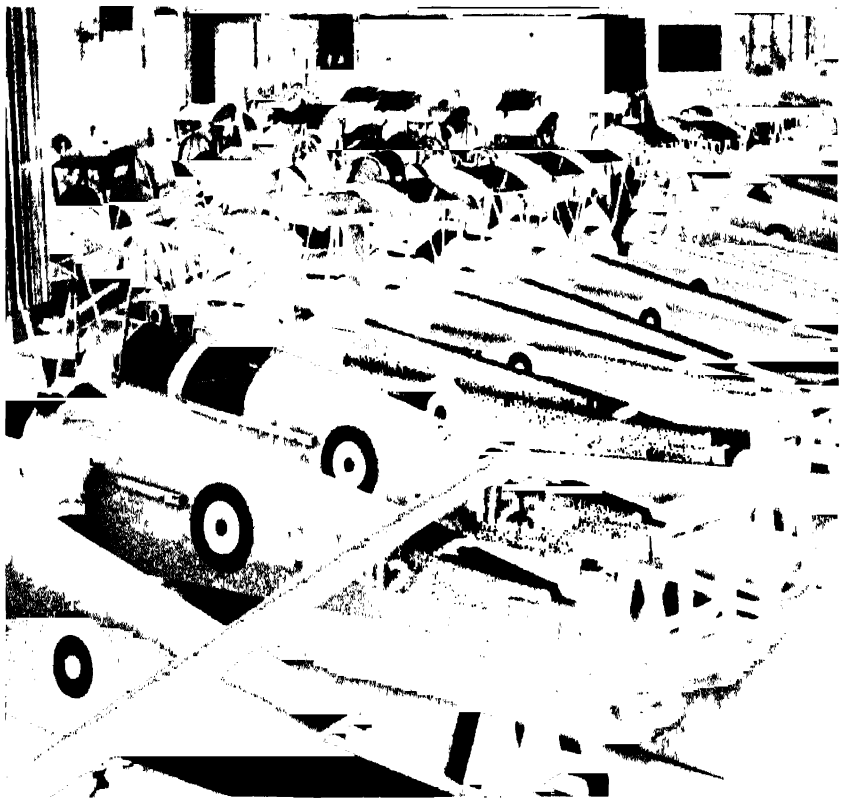
WASHINGTON — Steps have been taken by the government to straighten out priority ratings on munitions contracts to end the confusion existing among machine tool builders regarding orders with A-1 ranking The Army and Navy Munitions Board's Priorities Committee has sent to all machine tool companies a list of defense products most urgently needed arranged to indicate the order of their precedence

While this list is a military secret and cannot be published the fact is publicly known that gages and machine tools themselves head the list They ran ahead of guns shell aircraft parts tanks and other strictly ordnance items About $16-000 000 of gages will be required the next two years for the defense program and the capacity of the gage manufacturing industry now is only around $5 000 000 a year The shortage will be remedied as rapidly as possible by new plant additions to be built with government money by four gage makers—Pratt & Whitney Taft-Peirce Greenfield Tap & Die and Sheffield Gage

Machines for gage makers in fact are likely to receive the AA rating which is an emergency classification justifying a machine tool builder in taking machines right off the shipping room floor and delivering them, regardless of previous destination

Recently practically all machine tool orders in connection with munitions work have had an A-1 rating So many A-1 ratings were allotted, in fact that many machine tool companies say that such a rating merely insured a buyer against being shoved farther down the waiting list The AA emergency rating has been invoked in only a few rare instances for items whose identity has been kept secret

The preferential list prepared by the Army and Navy Munitions Board's Priorities Committee is intended to help machine tool builders to decide which orders should be filled first when conflicts occur in delivery dates It does not invalidate the general rule that the specified delivery date on an order means more than its priority rating Thus if a machine tool builder has an A-2 order for delivery Jan 2 and an A-1 order for delivery Jan 15 and if he has been able to arrange his production schedule in such fashion that he can meet both delivery dates, he is at liberty to do so



Wide World

Canada's Mass Production—*Nearest thing to the mass production methods of the American auto industry yet introduced into plane production in Canada, is the method used in building two seater dual-control light training planes Above is a line-up of the planes on the assembly floor*

Canada's War Bill, Over 2 Million Per Day; Industrial Employment Increases Steadily

MONTREAL—For the month of October Canada's war expenditures exceeded $81,000,000, or approximately $2,666,000 per day. In June and July Canadian war expenditures were at a daily rate of $1,300,000, in August about $2,000,000. Next year war and peace time expenditures will be somewhere between 2 and 3 billions, or about $9,000,000 per day.

War costs are being financed from higher taxes, borrowing within the country. The Excess Profits Tax takes 75 per cent of the increase in profits over a base rate, average profits during 1936-39. Observers soon expect the opening of U. S. financial markets to aid Canada.

Appoint Labor Board

To meet one of its big problems, a limited skilled-labor supply, a Labor Board has been appointed charged with the responsibility of training men for war industries, diverting skilled men from non-essential to war industries. Firms enticing men from plants engaged in war work will be fined. During the past six months the government's employment index has recorded an increase of 3½ per cent each month. Employment has increased most rapidly in plants making iron and steel products, automobile equipment, ships, and electrical equipment. Another new board, Wartime Requirements Board, has been appointed to increase the effectiveness of the country's war effort. H. R. MacMillan, now government timber controller, will head the new agency. Responsibility of the new board will be to unify the operations of war industries; in effect it will be a central planning board.

Canada's shipyards are preparing to build cargo ships for the British government. The following shipyards are equipped to build freighters: Canadian Vickers, Montreal; Dominion Steel & Coal Corp., Halifax; Canada Steamship Lines, Lauzon, Quebec; St. John Drydock.

Fleet Aircraft, Ltd., Fort Erie, Ont., has been awarded an order totaling $4,065,768 for the construction of advanced training planes. The craft is an all-metal, low-wing monoplane, has a maximum speed of 193 miles per hour, a cruising speed of 163. Production of these planes is already well advanced at the company's expanded plant.

Recent government awards are: Aircraft, Aviation Electric Ltd., Montreal, $64,598; Dominion Hoist & Shovel Co. Ltd., $13,900; Machinery, Canadian Fairbanks-Morse Co. Ltd., Ottawa, $14,136; Dominion Hoist & Shovel Co. Ltd., Montreal, $46,170; and International Harvester Co. of Canada Ltd., $12,538.

Munitions, Anaconda American Brass Ltd., New Toronto, Ont., $34,260; Shipbuilding, General Supply Co. of Canada Ltd., Ottawa, $55,212; and Halifax Shipyards Ltd., Halifax, $29,422.

Harris & Ewing



Old and New —*Are the towing carriages at the right. The machine pictured at the top has been pulling model boats through the water since 1900. Its replacement (below), if all predictions come true, is ready for the trip to the Carderock Basin, Md., the Navy's testing grounds. The apparatus allows a close study of the behavior of a ship before it is built.*

Concerns Seek U.S. Tin Smelter; Apply for Federal Finances

WASHINGTON — Eight different smelting concerns, some of them foreign and some domestic, have applied to the RFC's Metals Reserve Company for rights and federal financing to set up a tin smelter in this country. It is a reasonable guess that the Defense Commission and Laon Administrator Jones will choose a foreign concern, because an American concern would get little consideration from the world tin cartel, which is all-foreign, and probably would be squeezed out after the war.

Choice of concern may be announced before this report is printed. Tin ore will come from Bolivia, whose industry (outside of the Patino interests) has agreed to supply us with enough concentrate to produce 18,000 tons of fine tin per year for five years.

It is being predicted in Washington that the Defense Commission will soon ask manufacturers of munitions to use foreign copper which would be admitted free of the 4 cent excise tax.

New Towing Carriage, Designed By Navy, Tests Stability of Ships

LONG ISLAND CITY, L. I.—A new towing carriage, the function of which is to ascertain the overall characteristics of a boat prior to its being built, has just been completed by Machinery Builders, Inc., Long Island City. The apparatus, designed by Capt. H. E. Saunders, Technical Director of the David W. Taylor Model Basin, Md., will be moved this week to the new $5,000,000 Carderock Basin, Md., near Washington, D. C., where it will be operated.

The carriage, which is to the shipbuilder as the wind tunnel is to the airplane manufacturer, runs as a traveling crane in a steel mill, weighs 66,000 lbs., costs $200,000, travels at a speed of 15 to 20 miles per hour. As the machine pulls model ships through the water, it allows a close study of the ship's behavior. Hull lines and propeller design may be checked, the force required to propel a boat may be measured. The performance of a full-sized ship can be predicted in advance of its construction by study of the little prototype on its basin runs.

Navy men hope that the new model towing carriage will replace the one now in use. More rigidity, greater accuracy, and more varied findings are expected in the new machine. The apparatus has been designed on a principle similar to the carriage used in the high-speed seaplane basin located at Langley Field, Va.

C.I.O. and A.F.L. Conventions Indicate "Moderates" Are Taking Over Leadership

ATLANTIC CITY, N J—As the Congress of Industrial Organizations wound up its third Constitutional Convention in Atlantic City, and the American Federation of Labor marked its 60th Birthday by a conclave in New Orleans, all indications pointed to the fact that "moderates" were taking over the saddle of leadership

One of the puzzles was, just how serious will the CIO be in implementing its condemnation of Communists and subversive elements? Others will the eclipse of John Lewis mean a less belligerent CIO? How far is the AFL prepared to go in mopping up on its racketeers? Will the verbal castigations of each other by the two groups impede labor unity, or will it have served to let off steam and make peace more likely? On only one of these issues was there a hint of what to expect

It was the consensus that John Lewis or no John Lewis, the fire-eating days of the CIO are over The Atlantic City crowd was all officialdom, active policy-making officers of the CIO's 42 unions Except for the "Leftists" among them they were unanimous in recognizing that the temper of the times called for a different kind of union operation than that which identified the CIO in the past If the CIO is to expand further, its growth must be peaceful

Both labor meetings showed clearly that the unions are preparing to give new and greater emphasis to lobbying activities All elements acknowledged the increasing importance of government's role in the days which lie ahead The old orthodox philosophy of "voluntarism"—that labor should depend only on its own strength—seems to be outdated Although there were a few advocates of it at both conventions, they were a distinct minority A Rubber Workers Union official summarized the new philosophy when he said "one law, vigorously enforced, is worth more to labor than a hundred organizers and a million dollars" In effect, it means that the unions will give more attention to Washington and less to the factory gates

In a period such as this labor unions tend to stabilize The leadership entrenches itself in power and management finds union representatives more "reasonable" The danger of industrial disturbances come not from the union leadership, which tends to be conservative but from the rank and file of unionists who may interpret their leaders conservatism as timidity

Export of Machinery During September, 1940

	September 1940	August 1940	September 1939
Electrical Machinery and Apparatus	$9 244 111	$9 688 513	$8 062,687
Power and generating machinery except automotive and electrical	1 588 014	1 462 055	1 114 665
Construction and conveying machinery	2 07[illegible] 348	2 821 332	1 767 562
Mining well and pumping machinery	3 220 422	4 144 971	1 500 147
Power-driven metal working machinery	22 452 289	21 420 050	9 539 355
Other metal-working machinery	7 50 880	938 687	410 246
Textile machinery	1 021 113	1 111 173	819 714

Metal-Working Machinery

Engine lathes	840 509	024 332	118 944
Turret lathes	1 826 706	326 523	746 052
Other lathes	1 204 607	157 000	279 041
Vertical boring mills and [illegible]ocking machines	84[illegible] 087	333 471	498 728
Thread cutting and automatic screw machines	2 450 812	477 950	459 927
Knee and column type milling machines	[illegible] 080 351	756 859	644 152
Other milling machines	2 601 123	2 107 320	1 160 [illegible]95
Gear Cutting machines	629 683	836 626	222 030
Vertical drilling machines	408 458	361 218	111 165
Radial drilling machines	246 406	240 760	142 659
Other drilling machines	739 130	318 015	211 467
Planers and shapers	666 875	564 407	142 932
Surface grinding machines	[illegible]53 676	714 839	190 523
External cylindrical grinding machines	318 48[illegible]	579 583	192 638
Internal grinding machines	380 363	924 321	294 353
Tool grinding, cutter grinding and universal grinding mach	617 [illegible]70	718 869	278 27[illegible]
Other metal-grinding machines and part	1 217 310	1 567 809	471 071
Sheet and plate metal working machines and parts	828 237	764 546	384 713
Forging machinery and parts	948 97[illegible]	979 220	74 971
Rolling mill machinery and parts	1 100 010	1 175 648	1 038 370
Molding machines	32 818	39 616	9 879
Other foundry equipment and parts	126 083	165 777	206 256
Other power-driven metal-working machines and parts	1 731 624	2 083 228	1 348 384
Pneumatic portable tools	110 211	117 693	106 746
Other portable and hand or foot-operated tal-working machines and parts	191 805	197 447	119 006
Chucks for machine tools	62 345	56 264	28 042
Milling cutters, machine-operated threading dies and taps and similar machine-operated metal cutting tools	116 555	197 144	55 040
Other metal-working machine tools and parts	269 931	369 949	101 112

Vultee Aircraft Strike Sets an Administration Precedent

WASHINGTON—The Vultee Aircraft strike in Southern California has precipitated an administration precedent From now on, patient negotiation will be the rule in all except the most serious labor cases An extended strike in a major plant, of course, would not be tolerated Neither would the administration stand for a series of strikes against the defense program

You cannot get definite answer from experts in Washington on the legal status of unions striking against defense manufacturers—except one; that the chief executive, as Commander-in-chief of the Army and Navy under the Defense Act of 1916 and under recent acts, can issue an emergency order to break a strike and no doubt about it But they point out that the right to strike, like free speech, is guaranteed by law

It was unfortunate that both AFL and CIO leaders were tied up at conventions during the strike Sidney Hillman, whose duty as defense commissioner is to aid production, and as CIO executive to aid the strike, was on the hottest spot

There was talk of legislation to put defense production under a law similar to the Railway Labor Act under which strikes are legal only after negotiation and cooling off period, but this would take time—may not be further considered

Southern California aircraft plants are on a 50¢ beginning wage as compared with 75¢ at Boeing in Seattle There are regional, living standard reasons for this It remains to be seen whether raising Vultee basic wage will bring a general Southern California demand for increase Two plants down there are CIO two are AFL and the rest are independent or unorganized This set-up does not appear to lend itself at the moment to concerted action

Exports of Industrial Machinery Decline 4 Per Cent In September

WASHINGTON—U S exports of industrial machinery during September amounted to $36,890,941, a decline of 4 per cent from the August total of $38 466 083 However the feature of the month was the continued rise in exports of power-driven metal-working machinery, which surpassed the previous month's record total and reached the new high of $22,452,289 Shipments of machine tools to England amounted to $15,070,249, compared with $12,480,621 in August, and $7 354 726 in July, while consignments to Japan declined to $587,632 from $1 875 503 in August, and comparable exports to the Soviet Union dropped to $894,999 from $1,795,826

Factory Problems Caused by Defense Orders Discussed at American Management Meeting

CLEVELAND — Factory problems caused by present and prospective national defense orders superimposed upon rising domestic demand were discussed before the Production Division, American Management Association, which met at the Cleveland Hotel, Nov. 12-13. More than 600 executives attended. Problems most frequently mentioned were difficulties in changing from single to multiple-shift operation, finding skilled men, training unskilled operators, and keeping down scrap and repair losses

Most of the firms represented are now working two and three shifts, or even four six-hour shifts. Allan C Curtiss, assistant to the general manager, Scovill Mfg. Co., said: "In these days of high taxes with higher to come, real economy demands that floor space be kept to a minimum, equipment be utilized 24 hr. per day if possible, and replaced with new equipment to cut cost of production."

Mr. Curtiss said that apprentice training is operated regularly on a two shift basis with the hope that boys exposed to multiple shift operation will find night work less repugnant when working at the trade. These shifts rotate at six-week intervals. A third shift has been added for regular employees, but boys will probably not be rotated through the three shifts.

Multiple-Shift Operations

The foreman's importance in maintaining multiple-shift operations was stressed by Henry V. Oberg, industrial engineer, Armstrong Cork Co. He has found that the most satisfactory operation of a department results from complete responsibility for its operation being vested in one foreman, regardless of the number of shifts. The foreman-in-charge has under him shift foremen or hourly shift supervisors, depending upon the importance of the operation.



GEORGE H. PRUDDEN

George H. Prudden, works manager, Vega Airplane Co., subsidiary of Lockheed, explained how scientific selection methods have been employed to weed out undesirable applicants for skilled and semi-skilled jobs in a rapidly expanding enterprise Vega has 5000 men in training who have been selected by means of various tests, i.e. intelligence tests and mechanical aptitude tests Written and manual tests are useful in showing up the "trade bluffer." Approximately 20,000 case histories have demonstrated that these tests have given surprisingly good results in keeping misfits out of the organization and providing the material that can make good.

New and inexperienced help was perhaps the major cause of scrap and repair losses during Products expansion from 1591 to 3960 workers, reports W. H. West, assistant factory manager. Experienced help was converted to supervision and the ratio of inexperienced help rose rapidly. Scrap and repairs on some items equalled pieces shipped.

Warner & Swasey has expanded its learner training program, begun in 1935, to include a large number of observers, who are assigned to instructor-operators. Ray J Blyth, personnel director for Warner & Swasey, said observers were needed in anticipation of delivery of new equipment for the expansion program underway, that observers must meet the same requirements as other trainees. The object of the three to four month training period is to provide semi-skilled specialists able to handle a considerable amount of setting up or carry on a job remaining in the machine at the start of the shift.

BRITTON HEADS TOOL DIVISION

WASHINGTON—Mason Britton has been appointed Director of the Machine Tool and Heavy Ordnance Division of the National Defense Advisory Commission. He succeeds Harold Vance, chairman of the Board, Studebaker Corp., who has returned to active duty at Studebaker. Mr. Britton, who is vice-chairman of the McGraw-Hill Publishing Co., has been assistant to Mr. Vance since the Defense Commission was established. Mr. Britton will be assisted by Howard W. Dunbar, vice president, Norton Co.

CARLTON DIRECTS AUTO COMMITTEE

DETROIT—C. C. Carlton, vice president of Motor Wheel Corp., has been made permanent director of the Auto Committee for Air Defense. Mr. Carlton, who had been serving as acting director, has been granted a leave of absence from Motor Wheel, but he will continue to serve as president of the Automotive Parts & Equipment Manufacturers Inc. W. J. Cronin, Automobile Manufacturers Assoc., has been named assistant director.

Japanese Machine Tool Imports Decline; Retard Metal Exports

TOKYO—Japanese imports of machine tools for the first seven months of 1940 were estimated at $22,000,000. This marks a 25.8 per cent decrease for the corresponding period in 1939 when machine tool imports were $31,000,000. Imports of unspecified machinery parts were also off during this period from $11,000,000 to $7,500,000.

In order to check the outflow of steel and alloy metals, a new Department of Commerce & Industry order has prohibited articles made of iron or steel to be exported to markets other than Manchuria and China. Shipments to the latter are also subject to license. Japanese exports of machinery of every description during the first seven months of 1940 reached a value of approximately $73,300,000.

To replenish fast-waning stocks of iron and steel scrap, of which Japan imported 2,000,000 tons every year from the U. S., the Department of Commerce & Industry in Tokyo has decided to undertake a thorough investigation of machine tool and power plant installations, with a view to ordering inefficient, obsolete and idle plants turned into scrap. The steel obtained is to be used in the manufacture of new and more efficient machines. Some observers indicate that machine tools not yet put to use will be ordered scrapped if they do not meet the government specifications.

Electric Trucks and Tractors' October Bookings Set Record

CHICAGO—October bookings of electric industrial trucks and tractors were higher than any other previous month in the year. Figures compiled by the Industrial Truck Statistical Assoc., Chicago, indicate that 193 units were booked in October while 154 units were booked in September, the previous high month. Total net value at factories for chassis only was $653,682 compared with the previous high in July of $591,784.

INSIDE DETROIT

Rumor spreads that U. S. will build a plane assembly plant in Mid-west, that auto companies will help in mass production of airplane engines. Plans, however, are just in the "idea" stage

BY RUPERT LE GRAND, DETROIT EDITOR

DETROIT—Dame Rumor has allowed herself to get far ahead of the facts in regard to the auto, parts and tool industries' program to make plane parts for America and Britain. News despatches assert incorrectly that a $21,000,000 final-assembly plant for planes will be erected by the government in the Midwest, that the three major auto companies will produce the aviation motors required, and that structural components will be supplied by the three major body manufacturers.

Actually the whole program of producing planes by mass-production methods with the help of 1,000 local companies is hardly beyond the idea stage. Local executives early foresaw that two final assembly plants might properly be erected in the Midwest for assembling the Martin B-24 two-engined bomber and the Consolidated B-26 four-engined heavy bomber, respectively. These are new models "assigned" to the local effort. Chief reasons for this proposal, and that is all it amounts to at present, are the difficulties of getting together with distant plane plants on matters of manufacturing methods, limits, inspection of the hundreds of items in a bomber. In addition there is the difficulty of the shipping problem in connection with the larger structural elements.

Proposal Is Dynamite

There was dynamite in this proposal. Washington realized that. Some of the aviation crowd are reported very sore over seeing the auto industry getting set to produce plane parts in mass-production. They won't want the entire job handled in the Midwest, even if aviation men can be found to manage the final-assembly plants. So a "definite" statement that a $21,000,000 plant is to be erected near Detroit for final assembly purposes is viewed locally as "terribly premature." For one thing, the idea has not progressed to a definite plan; for another, why raise a political tempest over plant sites at this stage?

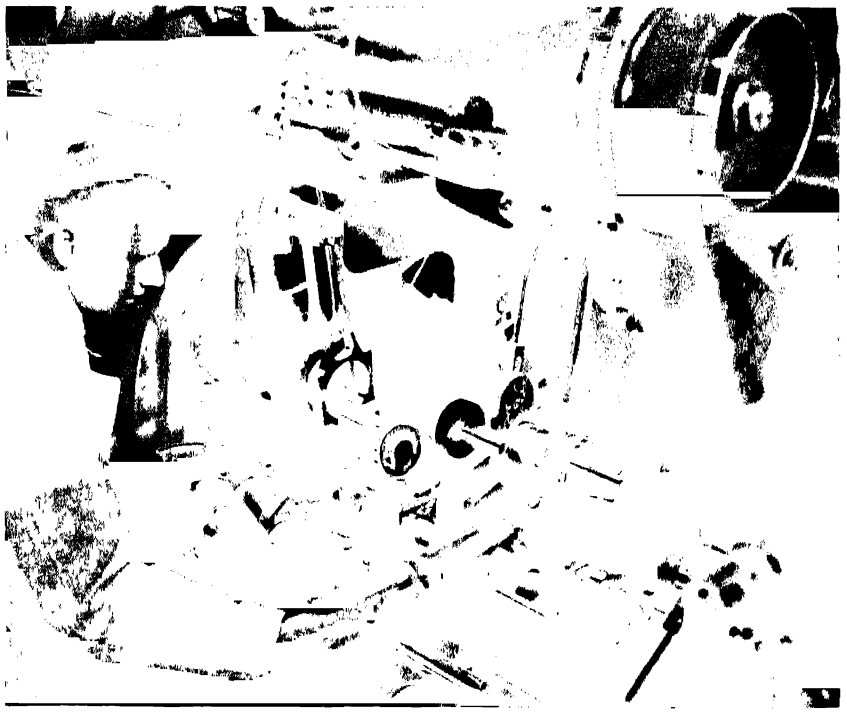
The line-up of auto companies which will produce aviation motors is nearly complete. Negotiations with Buick have been going on for production of Pratt & Whitney engines to about the same dollar value as ordered from Ford, according to reliable sources. Studebaker has been mentioned also. However, to place Chrysler in the picture along with General Motors and Ford is considered an error. It has been rumored that Chrysler has a 2000-hp. motor under development, and that they are very proud of the possibilities. But it is easy to forget that new aviation motors often require years of development and tooling work. Besides Chrysler has its hands full with one of the major jobs in the Army's list—tanks. Chrysler has leased 600,000 sq.ft. of floor space in the closed Graham-Paige plant, it is true, but the room is likely to be used eventually for other purposes than aviation motors. If a new motor is to be put into production, the play may go to the inverted twelve-cylinder design that Continental may have ready for final tests this fall.

Allison Division of General Motors has delivered 647 liquid-cooled engines since the first of July, after moving up to a production rate of 286 motors in October. Production will continue to gain slowly, attaining maximum capacity of 1000 motors per month about this time next year. Construction for the third expansion program will be completed in January, but all machinery will not be installed before September.

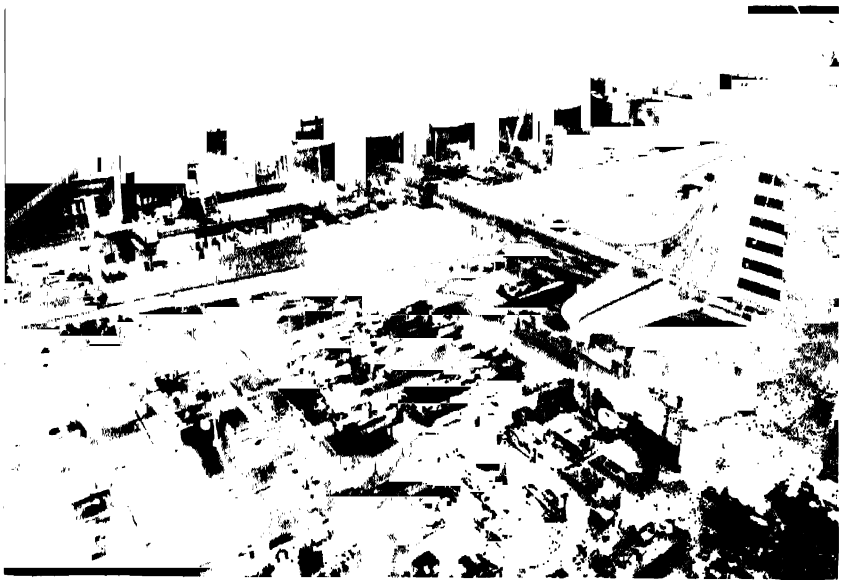
The first Allison expansion started in June, 1939, following receipt of an order for 969 engines from the War Department. More orders from the U. S. Government, the French

75 TANKS PER WEEK

DETROIT—Chrysler will build components for five tanks in one eight-hour shift per day, and will obtain certain assemblies from outside sources, usually two vendors per item, to boost the weekly assembly total to 75 units. Chrysler has purposely played down its achievements in tank development. Adaptation of auto assembly methods has in a measure simplified tank construction and at the same time made the "land battleship" much more effective Latest information runs to the effect that Carnegie-Illinois will completely fabricate and machine the armor-plate structure at its Mingo Junction, Pa., plant. Cast-steel turrets will likewise be completely machined by two vendors —American Steel Castings and General Steel Castings.



Marine Power—*Packard Motor Co. has produced hundreds of the 1,350 h.p. V-twelve marine engines which power American-built "mosquito boats". Orders from Canada, Britain, the U. S. total $17,000,000. Above operator backs up sizing indicator before removing part from fixture*



Guardian Of a Hemisphere—*In Santa Monica, Calif. the Douglas B-19, styled as the World's Largest Airplane, is being completed. The giant bomber has a cruising range of 7,500 miles, carries 28 tons, measures 212 ft. from tip to tip. It is powered by four 2,000 h.p. Wright engines*

and British made the second and third expansions necessary. The British order was received May 25 this year. A year ago, Allison employed 900 workers. Now there are 7,200 at Indianapolis and 1,750 in the parts division at Cadillac. When the production peak is attained, 10,000 men will be employed at Indianapolis and 3,000 at Cadillac.

Among the body manufacturers, Murray has already eliminated itself from the bomber project because its available facilities will be tied up upon producing inner wing sections for Douglas. The outer-wing sections for Douglas overflow work will be handled by Briggs.

Organizational activities of the Auto Committee for Air Defense, the body set up to represent the auto, parts and tool industries in surveying facilities to make parts for the projected bomber program, have moved rather slowly. For one thing, it has been difficult to find a permanent director able to conduct the affairs of the committee as though it were the "little finger" of the Defense Commission's hand

The Committee intends to incorporate itself as a non-profit organization. Administration costs will be recovered by charging a small fee to vendors who receive contracts.

Plans of the newly formed Aircraft Division, Murray Corporation of America, to make inner-wing assemblies for the Douglas A-20B two-engined bamber (a new type) will prevent the Detroit body manufacturer from participating in the program of the Auto Committee for Air Defense. All idle capacity has been reserved for the pending Douglas contract. Some 600,000 sq. ft. of floor-space have been made available for this work in the main plant.

While the Douglas contract has not been signed, both companies are working closely together upon a long-range mass-production plan. Published reports that Murray will make 1700 pairs of inner wing assemblies probably understate the amount of business to be handled. By the spring of 1942, Murray is expected to be in production of 75 pair of inner wings per week, and to be employing between 7500 and 10,000 people on the project. While it is impossible at this point to foretell the number of inner wings to be made and the number of years over which the contract will be in force, it is obvious that a manufacturing alliance of this size would not be undertaken for the published figures.

Murray is faced with the problem of putting one of the most complicated bomber structures upon a mass-production basis. The inner wing is literally a honeycomb of partioning elements and includes gas tanks, an engine nacelle, piping, hydraulic controls and a maze of other equipment. The structure must be riveted because present specifications do not permit welding. In plane plants an operator may perform several operations in connection with a riveting or assembly job because manufacture has been upon a small-lot basis. To attain mass production, however, Murray must break down each job into its simplest components and train an operator for each minute task. It is expected that production of inner wings will get underway in the spring of 1941, but the size of the training program faced by Murray will prevent the Aircraft Division from attaining the maximum production rate before spring in 1942.

EXPAND BRITISH PURCHASING COMMISSION

NEW YORK—The British Purchasing Commission has taken larger quarters here due to the increased activity of British purchasing of U. S. war material. The Commission which now employs 3,000 persons to handle its daily routine matters, has been able to increase its war orders in the U. S. due to recent action by the U. S. Priorities Board.

FBI Issues Booklet on "How To Protect Against Saboteurs"

WASHINGTON — A comprehensive booklet, "Suggestions for Protection of Industrial Facilities", has been prepared by the Federal Bureau of Investigation. This booklet is the result of a national survey by the FBI of the protective facilities employed by establishments having large government defense contracts. As an aid to industrial concerns in establishing effective protection against sabotage and espionage the FBI will provide organizations with such a booklet if requested by an executive official.

Physical Machine Tool Expansion To Date Disturbs Defense Planners

WASHINGTON—Defense Commission planners are disturbed about the absence so far of substantial physical expansion of machine tool capacity. Big increases in output are admitted, but these have largely been the result of three-shift operation and sub-contracting, expedients with definite limitations. The commission thus inherits a dispute which first arose when Secretary Morgenthau encountered resistance to his demands for what the industry considered undue expansion of physical capacity.

Although the commission is not unanimous on the point, a considerable group within it feels that production of civilian commodities must not be reduced, for fear of inflation if for no other reason. A machine tool output barely sufficient for defense would be fatal to this approach, which brings the problem sharply to the fore. Already there have been veiled accusations of unpatriotism and hints of a crackdown.

The commission is not unsympathetic to the industry's attitude. But the existence of the bankable contract plan, by which the government takes the financial risk and under which excess capacity at the end of the emergency can be turned back to the government, is felt to answer any reasonable objections.

WATCHING WASHINGTON

Millis' appointment to NLRB seen as bid for unity on defense problems. Federal Reserve aids small manufacturers to get in defense picture. Supreme Court strictly construes Wagner Act

By BLAINE STUBBLEFIELD

WASHINGTON — Appointment of Dr. H. A. Millis to the chairmanship of the NLRB, succeeding Warren Madden, whose term expired last August, has several important implications. It was the President's first major executive act since his re-election, and Washington takes it as a favorable gesture toward business for speed in defense production. Dr Millis is regarded as an independent thinker on industrial relations, and it is expected he will see pretty much eye to eye with William M. Leiserson, thus putting Edwin S. Smith in a minority position and ending the present deadlock.

The appointment is a bid for unity on defense problems also in that it appeases the largest possible group of opponents to the Labor Board—namely, the American Federation of Labor plus the business bloc which stands almost united against it The appointment is Roosevelt's answer to John Lewis' opposition and it is a great blow to Lewis and to the CIO.

Still further, a Millis-Leiserson dominated NLRB probably would put down any demand for a special labor board to adjudicate labor disputes involving production for the Army and the Navy.

There was no doubt, as this was written, that the Senate would confirm Madden without a murmur for a job among the ancient case records of the Court of Claims where the President proposes to pension him off as one of the five Claims judges.

Orders For Small Manufacturers

Arrangements have been made for the small manufacturer to determine whether and how he can get into defense production. Donald Nelson, Defense Commission coordinator of purchases, explains that the manufacturer, who has no representative in Washington and is not familiar with federal contracting, should go to a Federal Reserve Bank or a branch, an officer of which can tell the manufacturer (1) whether the Government wants to buy what he produces; (2) if not, then whether his plant is able to make something else the Government does want; (3) where to apply for credit if he needs it; (4) how to negotiate his contract if he is in line for one. The bank officer will also inform the Government of the manufacturer's business standing and his personal reputation. In a general way, the defense plan is for the big companies to run the assembly lines while the small firms of the nation feed them the parts, though of course some big firms still make a large part of their own.

Overtime Pay Still Required

The obligation of employers to pay time-and-a-half for time over 40 hours per week is not voided by the existence of a union contract calling for a workweek of more than 40 hours without payment of overtime, except in certain instances, Wage-Hour Administrator Philip Fleming has warned. Labor contract clauses providing for more than 40 hours without time-and-a-half will have no legal standing, he said. While the Administration is pledged to maintain the hours standards, it would not be safe to predict that it will succeed. It has already been pointed out by industry leaders that the hours standards were set up to spread employment for the unemployed. If and when nearly all employables are at work, the only effect of the law would be to force employers to pay high wages.

Wagner Act—No Penal Program

Some time ago the Labor Relations Board issued an order that Republic Steel must reimburse the Government for relief paid to workers between the time Republic discharged them and the time it reinstated them under order. Republic appealed to the Supreme Court All but two of the Justices (Black and Douglas) signed a majority opinion for the appellant. In effect they said that the Wagner Act is a remedial measure that it "does not carry a penal program declaring the described unfair labor practices to be crimes." They further said that "if such a deterrent effect is sufficient to sustain an order of the Board, it would be free to set up any system of penalties which it would deem adequate to that end." Reducing this decision to fundamentals, it means that the letter of the law, and not what the Board may choose to make it mean, shall be applied. Then if the law is not satisfactory, it is the responsibility of Congress to change it. And incidentally, the appointment of Dr. Millis to the Board is not regarded here as likely to afford sufficient administrative remedy as business sees the Act. The House of Representatives still wants its amendments, and they will be brought up before the next Congress.

MACHINE TOOLS AVAILABLE

WASHINGTON — More than 2,000 machine tools stored at army arsenals, principally at Rock Island, have become available for lease to private manufacturers with munitions contracts. These machines, in many cases, were delivered new to the arsenals toward the end of World War I and never have been used. Terms on which they may be leased are understood to be 12 per cent a year based on today's appraised value of the machines. In one case arrangements were completed with a machine tool builder to get machines on this basis without waiting for a formal contract.

"Not by A Bombsight!"

Having refrained from loose gossip about "the bombsight", we've earned the right to jot down a few facts. There are several sights; not just one. The Army has one or more and the Navy has one or more. The Army's most accurate sight is the one manufactured by the Sperry Gryoscope Company, and it is the one that has just been turned over to the British. It was turned over because the President, supported by a preponderance of public and military opinion, believes the front line of the United States is on the English Channel Whether or not this sight will drop a bomb down a rain barrel, as often reported, we don't pretend to know. It stands to reason that, with the fate of nations hanging on aerial warfare, best technicians of each are keeping up on the art. It is believed that Sperry will actually build and deliver most of the sights for the British, but some may be built by other firms, possibly some by the British themselves. If, a few weeks from now, you read of miraculous exploits by the RAF, you can assume the sight is as good as the stories about it. A plausible report is that a small shell is being placed in sights delivered to RAF which can be exploded at the will of the pilot.

Nationalized Plane Production, U. S. Ownership of Plant Seen

WASHINGTON — Nationalization of aircraft production, currently worrying some heavy thinkers, is largely a matter of terminology. In a sense it is already here; plane builders build what, where, and how they're told to from Washington. In the sense of government ownership of plant it is inevitable in the next few years. The new assembly plants to be built in the midwest in connection with auto-plant parts manufacture apparently will be government-owned—like the powder mills and tank factories. But the expansions being carried out by the private aircraft manufacturers are largely being financed by the so-called "bankable contract." Under this plan, the plants become the property of the government in five years unless the private operator decides to buy them back. If the emergency is then over and the airplane industry has shrunk to pre-war size few plants will be bought. Thus, by far the largest part of the industry will be government owned.

There is no evidence at present, however, of any interest in government operation of manufacturing plants. Indeed the long-existant Naval Plane Factory is not being notably expanded. Private firms run the plants, either as owners subject to an ever-increasing mortgage under bankable contracts or perhaps, in the new assembly plants, as agents of the government. How a post-war administration would feel about this remains to be seen.

18 Per Cent Increase in Gear Sales Is Recorded for October

WILKINSBURG, PA. — The American Gear Manufacturers Association, representing the Gear Industry of the U. S., reports that gear sales for October were 18 per cent above September of this year and 53 per cent above October of 1939. The ten months ending with October 1940 are 47 per cent above the corresponding period in 1939.

Comparative Index Figures

	1940	1939
October	216	141
September	183	126
August	191	96
July	141	89
June	129	90
May	133	93
April	128	88
March	114	104
February	116	86
January	123	91

The monthly average for the first ten months in 1940 was 147; for the same period in 1939, 100.4.

U. S. Government Contracts Awarded to Metal-Working Firms

(Does not include contracts under $100,000)

Source	Agency	Commodity	Amount
Western Cartridge Co., East Alton, Ill.	War	Cartridges	$1,112,500
Bethlehem Steel Co., Bethlehem, Pa.	Navy	Forgings	506,250
Carnegie-Illinois Steel Corp., Munhall, Pa.	Navy	Steel forgings	777,012
Universal-Cyclops Steel Corp., Bridgeville, Pa.	War	Steel rods	145,115
Carpenter Steel Co., Reading, Pa.	War	"	145,863
Bethlehem Steel Co., Bethlehem, Pa.	War	"	140,362
Allegheny Ludlum Steel Corp., Watervliet, N. Y.	War	"	144,866
Fort Pitt Bedding Co., Pittsburgh, Pa.	War	Metallic belt links	419,200
Struthers Wells-Titusville Corp., Titusville, Pa.	War	Forgings	127,000
Crosby Co., Buffalo, N. Y.	War	Cartridge cases	1,175,600
American Tool Works Co., Cincinnati, Ohio	Navy	Lathes	181,116
Clark Equipment Co., Battle Creek, Mich.	War	Tractors	743,457
Harvey Metal Corp., Chicago, Ill.	War	Machining forgings	245,030
Warner & Swasey Co., Cleveland, Ohio	War	Lathes	331,268
R. K. LeBlond Machine Co., Cincinnati, Ohio	Navy	Lathes	105,759
Guiberson Diesel Engine Co., Dallas, Texas	War	Diesel engines	2,915,095
International Harvester Co., Chicago, Ill.	War	Tractors	2,272,500
Consolidated Machine Tool Corp., Rochester, N. Y.	Navy	Lathes	487,165
Lodge & Shipley Machine Tool Co., Cincinnati, Ohio	Navy	Lathes	145,808
Grumman Aircraft Engineering Corp., Bethpage, L. I., N. Y.	Coast Guard	Airplanes	221,634
Aero Equipment Corp., Bryan, Ohio	War	Propeller hub assy	100,672
Bell Aircraft Corp., Buffalo, N. Y.	War	Airplanes	4,962,220
Superior Trailer Mfg. Corp., Indianapolis, Ind.	War	Trailers	539,002
Autocar Co., Ardmore, Pa.	War	Tractor-trucks	350,880
General Motors Corp., Chevrolet Div., Detroit, Mich.	War	Trucks	899,698
Mack-International Motor Truck Corp., Washington, D. C.	War	"	210,951
Jack-Heintz, Ltd., Palo Alto, Calif.	War	Starter assys	2,535,367
Gar Wood Industries, Inc., Detroit, Mich.	War	Carriages	1,918,983
J. G. Brill Co., Philadelphia, Pa.	War	"	148,060
Timken-Detroit Axle Co., Detroit, Mich.	War	High speed adapters	621,030
Saginaw Stamping & Tool Co., Saginaw, Mich.	War	Bomb trailers	234,562
Diamond T Motor Car Co., Chicago, Ill.	War	Service trucks	104,584
White Motor Co., Cleveland, Ohio	War	Scout cars	5,412,956
Bendix Aviation Corp. (Pioneer Instrument Div.), Bendix, N. J.	Navy	Indicators	651,947
Bendix Aviation Corp. (Eclipse Aviation Div.), Bendix, N. J.	War	Data transmission system	1,970,119
Struthers Wells-Titusville Corp., Titusville, Pa.	Navy	Forgings	184,295
Camden Forge Co., Camden, N. J.	Navy	"	116,893
Midvale Co., Philadelphia, Pa.	Navy	"	616,153
National Tube Co., Pittsburgh, Pa.	War	Body forgings	264,147
Lansdowne Steel & Iron Co., Morton, Pa.	War	"	176,640
Pennsylvania Forge Corp., Philadelphia, Pa.	Navy	Forgings	267,041
Erie Forge Co., Erie, Pa.	Navy	"	1,162,366
National Forge & Ordnance Co., Washington, D. C.	Navy	"	1,006,003
Crucible Steel Co. of America, New York, N. Y.	Navy	"	2,332,343
Harrisburg Steel Corp., Harrisburg, Pa.	War	Demolition bombs	265,000
Federal Screw Works, Chelsea, Mich.	War	Booster parts	560,774
Bridgeport Brass Co., Bridgeport, Conn.	War	Cartridge cases	364,965
Scovill Mfg. Co., Waterbury, Conn.	War	" "	244,200
" " " "	War	Fuse parts	288,000
" " " "	War	Booster parts	102,410
Stewart-Warner Corp., Chicago, Ill.	War	Fuses	1,371,360
Bullard Co., Bridgeport, Conn.	War	Boring mills	209,815
American Engineering Co., Philadelphia, Pa.	Navy	Windlass	517,200
Heil Co., Milwaukee, Wis.	War	Semi trailers	2,114,594
Standard Steel Works, North Kansas City, Mo.	War	"	1,182,005
Mercury Aircraft, Inc., Hammondsport, N. Y.	War	Trainer assys	125,737
Packard Motor Car Co., Detroit, Mich.	War	Aircraft engines	62,448,000
Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa.	War	Gun carriage	102,025
Breeze Corp., Inc., Newark, N. J.	War	Starters	195,030
Bendix Aviation Corp., Eclipse Aviation Div., Bendix, N. J.	War	"	271,308
McCauley Steel Propeller Co., Dayton, Ohio	War	Blade assys	308,880
Bendix Aviation Corp., Eclipse Aviation Div., Bendix, N. J.	War	Energizer assys	302,570
Glenn L. Martin Co., Baltimore, Md.	War	Gun turrets	738,555
Autocar Sales & Service Co., Ardmore, Pa.	War	Tractor-trucks	1,565,640
Ingersoll-Rand Co., Phillipsburg, N. J.	War	Machinery	449,434
Auto Ordnance Corp., Bridgeport, Conn.	War	Small arms material	3,108,854
Yellow Truck & Coach Mfg. Co., Pontiac, Mich.	War	Trucks and parts	3,381,915
U. S. Steel Export Co., New York, N. Y.	War	Ammunition components	150,832
Saginaw Stamping & Tool Co., Saginaw, Mich.	War	Trailers and accessories	289,599
Ford Motor Co., Alexandria, Va.	War	Trucks	171,430
Universal Crusher Co., Cedar Rapids, Iowa	War	Small arms material	244,125
J. Cunningham Sons & Co., Rochester, N. Y.	War	" " "	294,600
Square D Company, Kollman Instrument Div., Elmhurst, N. Y.	War	Indicator assemblies	222,000
Niles-Bement-Pond Co., Pratt & Whitney Div., West Hartford, Conn.	War	Drill Presses	120,255
C. M. Gosiger Mach'y Co., Dayton, Ohio	War	" "	141,500
Banner Die Tool & Stamping Co., Columbus, Ohio	War	Shackle assemblies	141,750
Spriesch Tool & Mfg. Co., Inc., Buffalo, N. Y.	War	" "	335,920
Bendix Aviation Corp., Bendix Products Div., South Bend, Ind.	War	Wheel-brake assemblies	235,526
Wright Aeronautical Corp., Paterson, N. J.	War	Maintenance parts for Wright engines	218,851
Bridgeport Brass Co., Bridgeport, Conn.	War	Artillery components	135,000
Square D Company, Kollman Instrument Div., Elmhurst, N. Y.	War	Altimeter assemblies	2,745,985
Weston Electrical Instrument Corp., Newark, N. J.	War	Indicator assemblies	1,509,420
International Harvester Co., Chicago, Ill.	War	Tractors	631,172
Crown Cork & Seal Co., Baltimore, Md.	War	Small arms material	1,147,030
American Car & Foundry Co., Milton, Pa.	War	Tank cars	679,640

NAMES in the NEWS

W. C. Buchanan, former president of Globe Steel Tube Co., Milwaukee, has been elected a member of the Board of Directors of Allis-Chalmers Mfg. Co.

George F. Chapline, vice-president in charge of sales of the Wright Aeronautical Corp., resigned that post to become president and general manager of the Brewster Aeronautical Corp. He has been identified with the Wright organization in various capacities since 1929.

Other changes in Brewster Aeronautical's executive set-up designed primarily to expand the company's executive forces to speed up production on more than $100,000,000 of defense orders for the United States Navy and foreign aircraft, included the election of James Work as chairman of the Board of Directors, in which capacity he will remain active in the affairs of the company; of Dayton T. Brown as vice-president in charge of research and development, and of William L. Smith as vice-president in charge of material.

William D. Kennedy, service manager of Wright Aeronautical for 12 years, will succeed Mr. Chapline as sales manager; Philip B. Taylor was made assistant general manager, and P. W. Brown was appointed assistant works manager.

John Dykstra, formerly general superintendent of production, has been named assistant works manager of the Olds Motor Works. Roy A. Fishel, superintendent of the Six and Eight Motor Plants, has been named night superintendent.

A. W. Gardes has been appointed factory manager of the Eureka Vacuum Cleaner Co., Detroit.

C. E. Harrison, vice-president of the American Engineering Co., Philadelphia, has been named general manager. He will have general supervision of the entire activities of the company in addition to his duties as vice-president.

E. J. Hunt, formerly general staff master mechanic of Chrysler Corporation, has been appointed operating manager in charge of the Chrysler Tank Arsenal. The $20,000,000 arsenal which is being built on contract from the United States War Dept. will begin to turn out medium (25 ton) tanks at the rate of five per day per shift in about a year. Mr. Hunt has been placed in charge of building, equipping and directing this operation.

L. R. Ludwig has been appointed manager of two newly combined sections of the Switchgear Div. of Westinghouse Electric & Mfg. Co. Mr. Ludwig, who has been manager of protective devices engineering for the last five years, will head the combined division of circuit breaker and protective devices engineering.

David S. Lewis has been appointed assistant to the sales manager of Jessop Steel Co., Washington, Pa.

E. R. Perry has been appointed executive assistant to the president of the Boeing Aircraft Co. Mr. Perry has served in a managerial and executive capacity with several leading manufacturing and sales organizations of the country, including the Eastman Kodak Company of Rochester, N. Y., and the Flintkote Co., New York. In the newly-created position, which he will occupy in the expanding Boeing Aircraft Co., Mr. Parry will assist in the executive and administrative work of the president's office.

W. Rogers, general factory manager of Caterpillar Tractor Co., Peoria, Ill., will retire on December 1. The position of general factory manager in the company will be discontinued.

W. T. Roundy has been transferred to the Atlanta office of Cutler-Hammer Inc., Milwaukee.

Ralph H. Rowland, sales manager, and Charles E. Dewar, superintendent, have been named vice-presidents of the Champion Spark Plug Co., Toledo. Mr. Dewar has been given charge of production in all company plants including the British and Canadian units. Charles L. Corwin succeeds Mr. Rowland as sales manager.

William F. Wise, president, Republic Aircraft Corp., has been elected executive vice president of Aviation Manufacturing Corp. He will continue to head the activities of Republic in addition to his new duties. At one time Mr. Wise was vice president in charge of sales of Ex-Cell-O Corp.

Jack F. Wolfram, experimental engineer, has been named assistant chief engineer in charge of engine, transmission and the axle design

Leaves Caterpillar



W. ROGERS

Engineering Co. Mgr.



C. E. HARRISON

Heads Tank Arsenal



E. J. HUNT

V-P at Aviation Corp.



WILLIAM F. WISE

Wright's Ass't Mgr.



P. W. BROWN

Oldsmobile Promotes



M. A. THORNE

and development division of Oldsmobile. Maurice A. Thorne, chassis engineer, has been named assistant chief engineer in charge of body, chassis, electrical, accessory groups and office administration. John Oswald, body engineer, will serve as Oldsmobile's director of styling.

Gordon R. Walker, has been named vice-president and sales manager of the Walker Mfg. Co., Racine, Wis., succeeding Malcolm McCormick, who has resigned.

Oliver Smalley, vice-president, and H. B. Hanley, secretary-treasurer, both of the Meehanite Research Institute of America, Inc., have been reelected.

PLANT EXPANSION

Kearney & Trecker Corp., West Allis, Wis., is erecting two new additions to its plant at a cost of $10,000.

Ex-Cell-O Corp., Detroit, will embark on a $3,000,000 expansion program for stepping up manufacturing facilities on precision aircraft parts by 50 per cent. Work has already been started in the new plant, and it is expected that it will be up to full capacity by April.

Air Associates, Inc. will start construction within a few weeks of a $200,000 one-story plant at the Los Angeles Municipal Airport. The floor area will cover 50,000 sq.ft. and will double the present capacity of West Coast operations of the company. The company is the largest manufacturer and distributor of Aviation parts and equipment in the world.

Wakefield Brass Co., manufacturer of commercial lighting equipment, will begin an expansion program to double the size of its plant in Vermilion, Ohio.

Houde Engineering Corp., Buffalo, will construct a $500,000 plant to manufacture precision instruments for the national defense program.

High Standard Mfg. Co., New Haven, Conn., will erect a new factory at Hamden, Conn. Expansion has been prompted by a $12,000,000 for 12,400 .50 caliber machine guns placed with the company by the British Purchasing Commission.

Tennessee Coal, Iron and Railroad Co., Birmingham, Ala., United States Steel subsidiary, has embarked on an expansion of the steel making and finishing facilities. An approximate 20 per cent increase in the ingot capacity, the finishing capacity, will be provided by the new facilities.





Photo by Christian Science Monitor

Heads Council—*Ralph E. Flanders, President, Jones & Lamson, Springfield, Vt., has recently been made head of the New England Council. Mr. Flanders is a past-president of the A.S.M.E. Above he is seen examining a new artillery range finder*

Diamond T Motor Car Co. has started work on a second large addition to its Chicago plant. The unit will be 600x120 ft. and will cost $175,000. The additional space is required to take care of two government orders totalling 2,998 trucks which cost about $19,220,000.

Pratt & Whitney Div. of Niles-Bement-Pond Co., manufacturers of precision instruments, will add a $750,000 addition to its West Hartford, Conn. plant. Employment will be provided for an additional 600 to 700 men.

BUSINESS ITEMS

Lidgerwood Mfg. Co., Elizabeth, N. J., has acquired the Superior Iron Works, Superior, Wis.

The National Fireworks Co., Whitman, Mass., has taken over the plant formerly occupied by the Atwood Box Co., and will manufacture cartridges up to .50 caliber.

The Lockheed Aircraft Corp., has purchased Union Air Terminal, Burbank, Calif., subject to approval by the Civil Aeronautics Board, from United Airlines for $1,500,000.

International Nickel Co. of Canada, Ltd., and subsidiaries, have net profit of $26,425,104 for nine months ended Sept. 30 after all charges, reserves, taxes, etc. equal after preferred dividend requirements to $1.71 each on the 14,584,025 no par common shares outstanding. Assets as of Sept. 30 were $95,055,604.

Columbia Axle Co., Cleveland has been purchased from Aviation & Transportation Corp., by Walter E. Schott and Louis Goldsmith, manufacturers. Columbia Axle is engaged in the manufacture of two-speed axles and in the machining of bombs and other defense work.

OBITUARIES

Charles L. Cameron, sales engineer of the Monarch Machine Tool Co., Newark, N. J. office, died recently of a heart attack. Mr. Cameron had been a member of the Monarch organization since 1927.

J. Philip Jayme, manager in charge of the operating department of the Crucible Steel Co. of America, died of a heart ailment at the age of 75. From 1881 until it was absorbed by the Crucible Co. in 1900, Mr. Jayme was employed by the La Belle Steel Works in Pittsburgh. He has been operating department manager of the Crucible Co. since 1921.

Seymour G. Van Arnam, 80, former sales manager of the Buffalo Pitts Co., at one time the largest manufacturer of threshing machinery in the world, died in his home recently.

Robert L. Crane, president and general manager of the Robert L. Crane Co., Buffalo, died suddenly of a heart attack two weeks ago. He was 68 years old.

Archie W. Lucas, New England sales manager for the Jessop Steel Co., Washington, Pa., died recently. Mr. Lucas had been a member of the organization since 1929.

MEETINGS

American Society of Mechanical Engineers. Annual convention. New York, N. Y., Dec. 2–5.

Motor & Equipment Manufacturers Association. Annual meeting. Blackstone Hotel, Chicago, Ill., Dec. 10.

National Exposition of Power and Mechanical Engineering. Grand Central Palace, New York, N. Y., Dec. 2–5.

Society of Automotive Engineers. Annual meeting, and engineering display. Book-Cadillac Hotel, Detroit, Mich., Jan. 6–10, 1941.

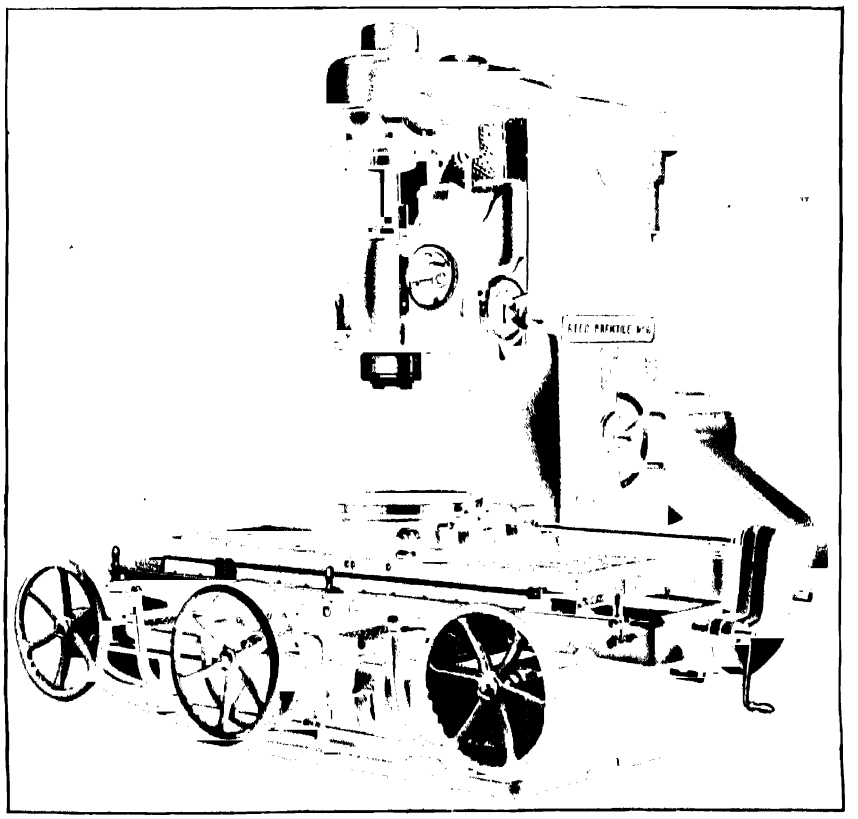
SHOP EQUIPMENT NEWS

Reed-Prentice Vertical Miller and Die Sinker Uses Totally Inclosed Gear Drive to Spindle

A totally inclosed gear drive, with all shafts running on Timken roller bearings, is used in the No. 6 vertical miller and die sinker manufactured by Reed-Prentice Corp., Worcester, Mass. Head provides double back gearing with drive to spindle at lowest point, securing maximum power and rigidity. All driving gears are of heat-treated alloy steel.

The saddle extends the full table length, forming a rigid support for the table. It has four bearing surfaces, scraped to the base. The table, which is likewise scraped to the saddle, has five T-slots serving as oil channels, and oil pockets at each end. Longitudinal and cross feed screws are of heat-treated chrome molybdenum steel, with threads milled and polished. Maximum operating efficiency is secured through a power rapid table traverse in either direction at 95 in. per min.

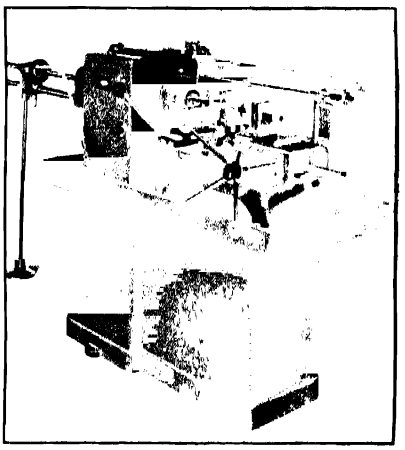
Heat-treated forged chrome vanadium steel spindle is mounted on Timken tapered roller bearings It is provided with a 12-in. graduated scale and micrometer stop for accurately feeding to depth. Both spindle and head are provided with counterweight. Twelve spindle speeds ranging from 15 to 500 r.p.m. are available. For each spindle speed there are eight feeds.



Oster "Rapiduction" Lathe Built for Easy Operation

Designed primarily as a low cost manufacturing tool for simple turning operations, the "Rapiduction" lathe developed by Oster Mfg. Co., 2057 E. 61st Pl., Cleveland, Ohio, has a capacity of 1½-in. round for cutting-off, boring, tapping, facing, threading and other jobs Capable of being operated by semi-skilled labor, this machine is equipped with a cross slide and saddle and is quickly and easily set up for three operations.

Spindle head is totally inclosed, carrying the spindle and worm shaft which runs in oil Spindle runs on ball bearings and is built with American standard flanged type nose It is driven by a hardened and ground steel worm and bronze worm gear. Worm shaft is also mounted on ball bearings Multiple V-belts from the motor to worm shaft is the method of drive, speed changes being obtainable through quick-change sheaves giving spindle speeds from 140 to 1000 r.p.m. A coolant pump, mounted in the base, is driven by a V-belt from the motor.



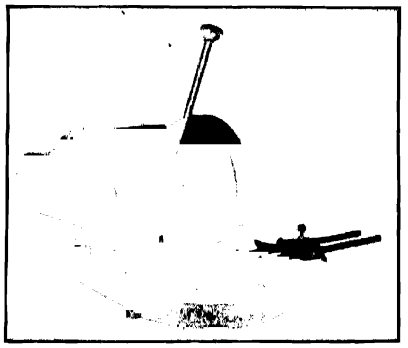
Mounted on the carriage with key and T-bolts, the toolpost is provided with longitudinal adjustment for the length of the carriage. A variety of chucking equipment is obtainable, including faceplate, automatic and universal and either manual or automatic stock stop. Power is furnished by a 2-hp. 1800/3600 r.p.m., induction motor with reverse or electric braking optional.

The machine has a swing of 13 in. over its bed and 6 in. over the cross slide. Floor space required is 33 x 70 in. without bar feed extension. If bar feed is used, it extends 94 in. beyond the pan. Net weight of the machine is 1386 lb.

Catskill Abrasive Machine Cuts Off Metals, Plastics

Hard metals, plastics and ceramics can be cut off with the Model D dry abrasive cut-off machine built by Catskill Metal Works, Inc., Catskill, N. Y. Abrasive wheel and motor are balanced on a heavy cast iron spindle frame, doing away with counterweights. Alloy steel spindle is equipped with alemite lubricated ball bearings. Spindle frame has adjustable two-way stop to regulate depth of cut.

Wheel guard is of heavy construction, bolted to spindle frame and equipped with a special panel which may be quickly removed for changing

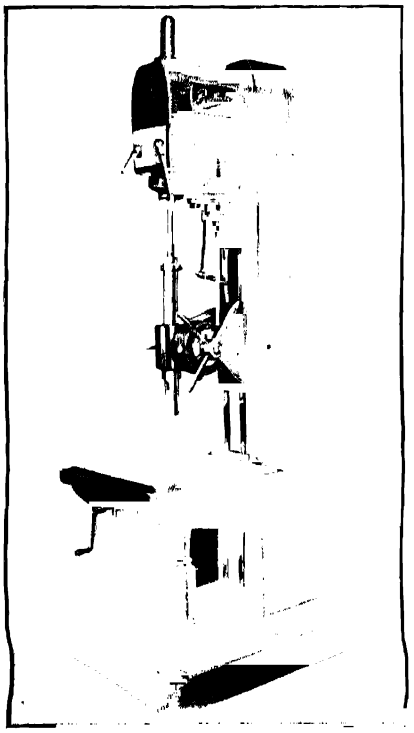


wheels. Swivel V-block vise allows cuts from 90 to 45 deg. angles. Cutting gage is adjustable from 0 to 18 in. The machine is driven by a 1½ hp. 3 phase ball bearing 3600 r.p.m. motor, driving through two V-belts. A 10-in. diameter abrasive wheel is used.

Buffalo "RPMster" Drill Has 100 Spindle Speeds

Any of 100 spindle speeds can be selected with the motor running on the "RPMster" drill press offered by Buffalo Forge Co., Buffalo, N. Y. Two sizes, with capacities of 1½ and 1 in. in cast iron, are available. Both have an overhang of 13 in.

Machines can be furnished with or



without back gears and with or without power feed. All controls are within easy reach of the operator. Motor and controls are built into the pedestal. Drive is through V-belts. Space under spindle nose is 27 in. Table measures 23 x 22 in. Weight is approximately 2,300 lb

South Bend 16-In. Toolroom Lathe Saves Time on Precision Work

The Series S toolroom lathe announced by South Bend Lathe Works, 426 E. Madison St., South Bend, Ind., is claimed to be especially adapted to fine work. A convenient control arrangement saves time and effort, reducing operator fatigue and assuring maximum production. Large handwheels facilitate precision adjustments on close work. Adjustable micrometer collars on the cross feed screw and the compound rest screw



are large with clear-cut graduations.

Toolroom attachments supplied with the lathe include handwheel type draw-in collet chuck, telescopic taper attachment, micrometer carriage stop, thread dial indicator, and chip pan. An electric grinding attachment, milling attachment and other attachments, chucks and accessories are available.

The telescopic taper attachment is permenently fixed to the lathe carriage and is always ready for use, regardless of the position of the carriage. To engage the taper attachment, it is only necessary to *tighten two binding screws.* The telescopic cross feed screw eliminates the necessity of disconnecting the cross feed nut when the taper attachment is to be used. The cross feed screw may be used to adjust the turning tool for the required diameter, and the taper attachment may then be engaged. To change back to straight turning, it is only necessary to loosen the two binding screws.

The fully inclosed underneath motor drive provides eight spindle speeds ranging from 21 to 725 r.p.m. Vibration-free operation at high speed is achieved by using a direct belt drive to the carefully balanced cone pulley and spindle assembly. Motor and driving mechanism are mounted in the cabinet leg under the headstock. Back gears provide slow spindle speeds and ample power for machining large diameters. A convenient belt tension release lever and wrenchless bull gear lock permit rapid changing of spindle speeds.

A quick-change gear mechanism provides 48 power longitudinal carriage feeds from 0.0015 in. to 0.0841 in., 48 power cross feeds from 0.0006 in. to 0.0312 in., and 48 right and left hand screw threads from 4 to 225 per in.

Large headstock spindle bearings provide extreme rigidity to reduce chatter. Alloy steel spindle has all bearing surfaces carburized, hardened and precision ground. Spindle journals are superfinished to a smoothness of 5 microinches. Bed is a heavy semi-steel casting with three large V-ways and one flat way. Carriage is heavily constructed, with long bearing surfaces. Apron is a double wall one-piece type, providing rigid support for both ends of all gear shafts. Power carriage feeds are operated by a worm drive and a series of steel gears in the apron which run in an oil bath. Power

feeds are controlled by a multiple-disk clutch.

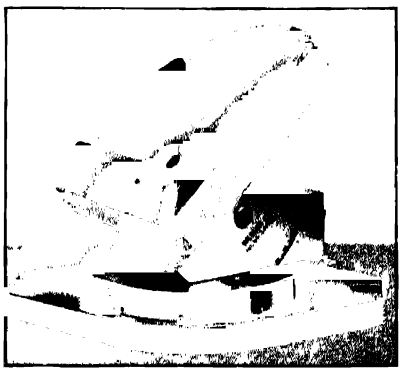
The Series S lathe has a 16-in. swing. It is made in bed lengths of 6, 7 and 8 ft., with center distances of 34, 46 and 58 in. respectively. The headstock has a 1⅝ in. capacity through the spindle, and takes collets up to 1 in. capacity.

Universal Angle Plate Fits Various Machines

The universal angle plate announced by Wesson Co., 1050 Mt. Elliott Ave., Detroit, Mich., is said greatly to increase the range of work which can be done on drill presses, grinders and milling machines. Instead of vise jaws, the universal base with patented cradle design is fitted with a slotted top plate.

The plate may be adjusted in three planes, each plane completely graduated. Through the use of this device, parts which are too large or of too irregular shape to be held conveniently in a vise can be clamped by T-slots in the top plate.

The device provides an important advantage when work involves a number of different operations using



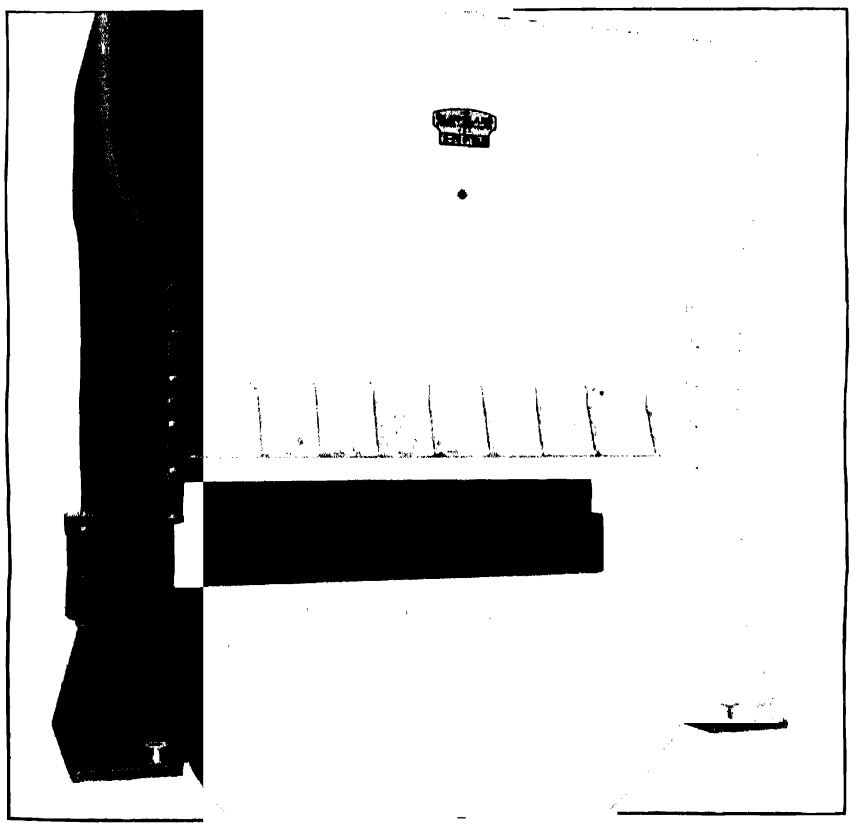
the same angle. Once the work is clamped to the angle plate and the angle established, it need not be disturbed as the entire device may be moved from one machine to another without removing the work.

Cleveland Punch & Shear Works Builds 750-Ton Two-Point Press

The 750-ton two-point press developed by Cleveland Punch & Shear Works Co., 3900 St. Clair Ave., Cleveland, Ohio, measures 156 in. between the uprights and has an over-all height of 260 in. Press is symmetrical front and back, the double gearing and the drive unit being located in the box type crown. It is equipped with a pneumatically operated friction clutch and brake, and the flywheel is provided with an air brake to bring the flywheel to a quick stop whenever the power is shut off.

The slide is counterbalanced by air, the cylinders being located in the uprights where they are readily accessible and can easily be removed without disturbing any other portion of the press. The bed, which measures 52 in. front to back and 156 in. right to left, is equipped with a T-slotted bolster plate and pneumatic cushions. Slide stroke is 12 in. Press operates at a speed of 9 strokes per min.

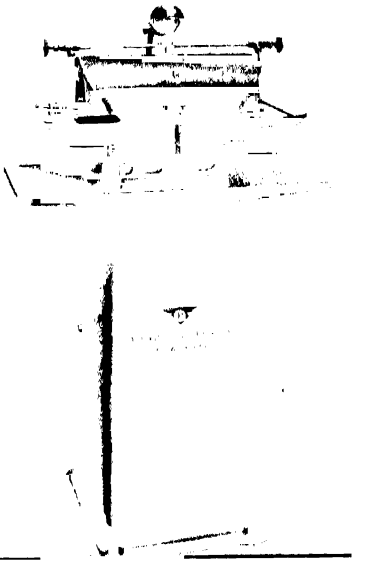
All gears run in oil, and there is an overflow limit in all gear housings to permit excess oil to return to the reservoir in the slide. All bearings are lubricated by an automatic power operated pump.



Carbide Tool Grinder Built for Heavy Duty

As a companion to the Model AA machine, the heavy duty carbide tool grinder offered by Thos. Prosser & Son, 120 Wall St., New York, N. Y., embodies all the features of the smaller machine, plus ample power for grinding the heaviest tools. It also incorporates provision for wet grinding.

Machine provides for rapid metal



removal when roughing, and for accurate finishing of all single point tools with flat surfaces held exactly to the desired angles. Absence of vibration makes it suited to the use of diamond wheels At the same time, it has ample power and stamina to permit the use of the coarsest roughing wheels. High-speed steel and Stellite, as well as carbide tools, can be ground economically.

Wet grinding equipment provides a copious coolant flow, permitting faster grinding of all types of carbide tools without danger of cracking or checking, and resulting in less wheel wear. Equipment consists of a coolant pump, pan, and settling tank.

The grinder is equipped with quick-acting indexing tables, permitting instant setting to the desired

angle It is never necessary to raise or lower the table as its edge always remains at the same point with respect to the wheel face Spindle runs in double-row, self-aligning, precision ball bearings, with labyrinth dust seal, driven by double V-belts The grinder uses either diamond or silicon carbide cup wheels on either end so that any combination of wheels can be employed Cup wheels are mounted on steel backing plates, and their location on the shaft is adjustable to compensate for wheel wear The wheel face can be kept close to the table and the wheels can be almost entirely consumed A totally enclosed dust-proof motor is supplied, with a drum type on-off-reverse switch, so that roughing and finishing of both right and left-hand tools are convenient

Die Finishing Equipment Makes Short Runs Feasible

Equipment for finishing and servicing Carboloy drawing dies for producing special shapes of bar and rod introduced by Carboloy Co, 11149 E Eight Mile Road, Detroit, Mich, permits users to employ such dies economically for short as well as long runs The company is also offering shape dies, in low-priced cored or pre-formed states, for rapid finishing to shape with the new line of equipment

The line comprises standard hexagon and square rough cored dies available in a wide range of sizes These dies require minimum stock removal for finishing to the usual sizes, the cored shapes being virtually identical to the usual forms of drawing dies

Equipment consists essentially of a die-bearing sizing machine, a die shaping machine, a hand polishing tool and an adaptation of a bench shaper for machining the required laps All three machines have the same basic action—a short high-speed reciprocating stroke In all cases an electric motor drive actuates an eccentric which in turn imparts a reciprocating motion to the vertical spindle

To rough and finish the bearing of the dies, laps of the same shape as the bearing, but with 0 010 in taper, are used, the number of laps depending on the number of times 0 010 in must be removed Laps for producing entrance, approach, bell and back relief angles also are smaller In lapping the angles, the lap is reciprocated by the vertical spindle At the same time, die and spindle are rotated slowly by hand The finishing or polishing hand tool also employs laps, reciprocated at high speed through an electric motor driven eccentric with a short stroke

A special adaptation of an Atlas bench shaper has been worked out for machining the laps The swivel plate on this shaper is mounted at an angle so that in the normal position a 0 010-in taper is produced on the laps The swivel plate is set over at a 5-deg angle to the stroke so that feed marks will be at an angle to the lap axis, producing a filing action



Abrasive Cleaning Machine Cleans Three Parts at Once

Three small parts at once can be cleaned or stencilled with the semi-automatic sandblast machine built by Leiman Bros, Christie St, Newark, N J The machine is entirely self-contained, all of the work being done under cover, without the discomfort of flying sand or dust particles

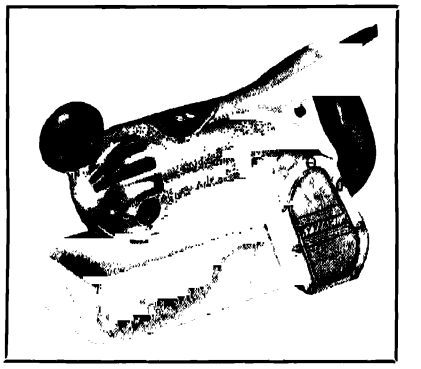
In addition to the machine itself, there are three revolving tables—each table holding several fixtures for the parts A motor-operated table brings one part inside the cylindrical sandblast cabinet and directly under two enclosed sandblasting nozzles After hesitating under the nozzle, for a predetermined time, the table rotates to the next fixture The same procedure is simultaneously taking place at the other two tables An attendant at each revolving table removes a finished article when the table comes to a standstill and replaces it with a new article to be sandblasted



The sandblast unit itself with its three enclosed nozzle stations of two nozzles each, is cylindrical in shape with a strong suction motor-driven dust collecting fan and dust separator This dust collector maintains an indrawing draft at each nozzle station, preventing any outward escape of dust A cleanout section is provided for removing abrasives deposited in the form of dust in the separator All nozzles are continuously fed with abrasive which can be used over and over until entirely consumed or reduced to dust

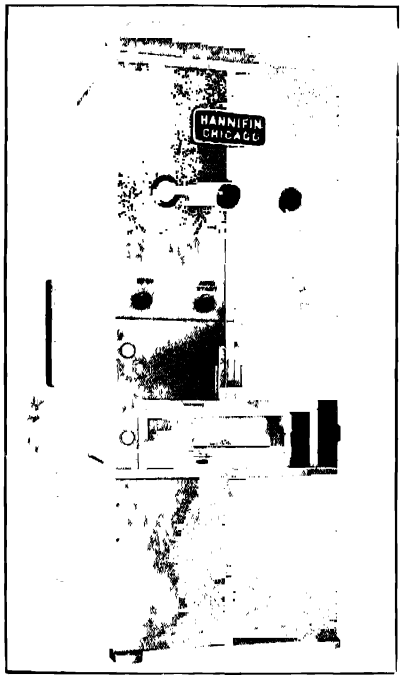
"Zephryplane Junior" Sander Suitable for Light Work

The "Zephyrplane Junior" 2¼-in belt sander made by Skilsaw, Inc, 5033-43 Elston Ave, Chicago, Ill, is especially suitable for "clean up" work and for many final finish operations Among its features are a die-cast aluminum frame, ball bearing construction, and a universal motor A patented control lever permits quick belt changes Belt travels at 600 ft per min, and is kept uniformly taut by a coil spring The sander weighs only 9½ lb



Hannifin Centrifugal Quenching Machine Saves Time and Minimizes Distortion

Designed for handling many types of circular parts, the centrifugal quenching machine developed by Hannifin Mfg Co, 621-631 S Kolmar Ave, Chicago, Ill, is claimed to avoid distortion and save 80 per cent of quenching time by providing accurate control of the quenching process Coolant is applied to the entire circumference simultaneously, with progressive quenching toward the center of the piece The machine provides correction of mechanical alignment of the parts when hot, with adjustable pressures on fixtures to give flattening and rounding effect as necessary Closely controlled are time of quenching operation, volume of quenching medium, and temperature of quenching medium as quenching progresses

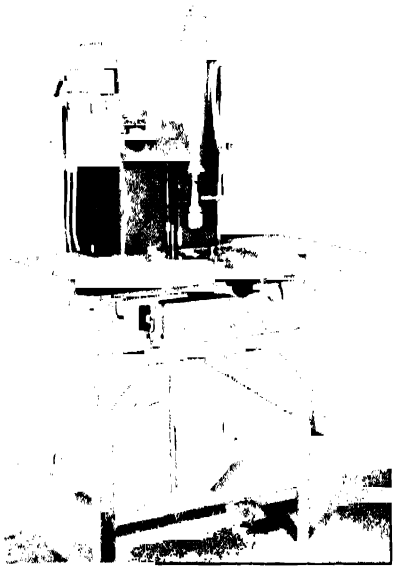


In operation, the heated part is placed on the lower fixture, after which the automatically operated holding fixtures close and provide a mechanical straightening effect or alignment of the hot part When closed, the entire assembly of quenching chamber, holding fixture and hot part is rotated by a motor Quenching oil is then introduced at the outer edge of the revolving container As the oil volume is increased, quenching takes place from the circumference of the part toward the center Oil flows out of the revolving chamber under controlled conditions, so that uniformity of temperature is maintained by fresh oil Complete automatic cycle occupies from 40 to 60 sec on typical gears and sprockets, as compared with 4 to 5 min required by usual methods Sectional quenching under controlled conditions is easily obtained, allowing the center of the part to remain unquenched, resulting in differential hardness of the finished piece

Plastic Drawing Presses Made Available by Taber

Taber Instrument Co, North Tonawanda, N Y, has announced a series of hydraulic and mechanical presses equipped with special tooling for deep drawing transparent sheet plastic such as cellulose acetate, Ethofoil, and Vinylite Many transparent containers and other products formerly made with cemented joints can now be drawn to shape without visible seams Objects up to 3 in diameter can readily be made with a hand press having a 6-in stroke with a capacity of about ½ ton, while larger articles requiring pressures of one to three tons are best produced on the hydraulic press illustrated – This press has a 10-in stroke a ram speed of from 30 to 60 in per min and is capable of a sustained production of 600 pieces per hour Pressure is supplied by a vertical vane type pump submerged directly in an oil reservoir

Operation of the press is as follows Disks of the required diameter are cut with a die made of steel cutting rule These disks are then placed one at a time between the electrically heated draw plates The draw plates are clamped together either by hand clamps or automatically when the foot pedal is depressed drawing the part which is then ejected from the machine into a chute while the ram returns to the starting position The unit is self-contained, having a compressor mounted in the base to supply air for ejection and other purposes

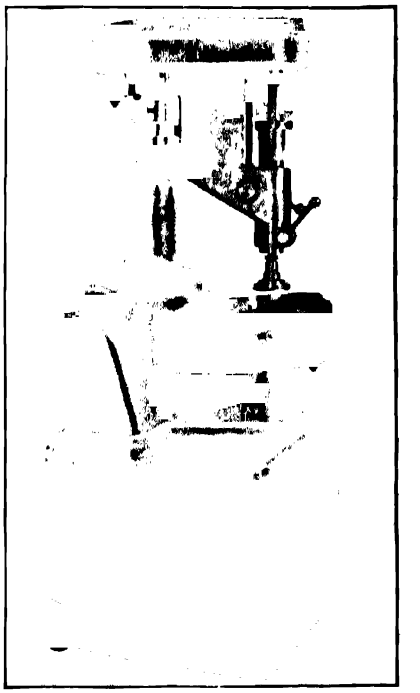


Die temperature must be held within two degrees of the ideal temperature determined for the particular operation A dial thermometer mounted on the front of the machine indicates the temperature which is automatically controlled by thermostats in the die A thermostat control box located just beneath the table indicates thermostat operation by a neon light

Electrical equipment includes a magnetic starter air compressor, oil pump, and heating equipment A control governing press speed is mounted on the frame immediately to the left of the operator This enables speed adjustment for the particular part to be readily made

Flats Finished in Production With "Ultra-Lap" Machine

Any number of flat surfaces with virtually identical characteristics of flatness and smoothness can be produced on a production basis with the "Ultra-Lap" machine offered by Ultra Lap Machine Co, 246 McDougall Ave, Detroit, Mich Due to multiplicity of motions, light pressure and type and quantity of abrasive, any material may be lapped without danger of loading abrasive into the finished surface Limits of less than one light band (0 000012 in) for flatness and one micro inch rms for flatness and smoothness can be met

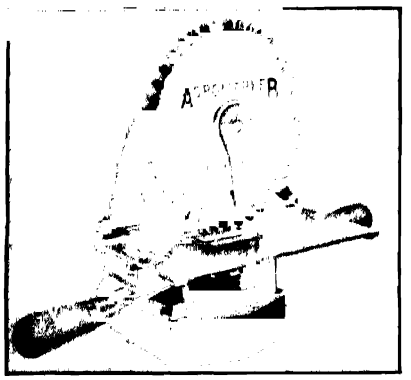


The machine is designed for easy operation and is built to stand up under continuous operation It mechanically reproduces the motion most used in hand lapping opera-

tions. Lapping plates stand up for an extremely large number of surfaces before they require reconditioning. It is claimed that the only time it is necessary to remachine the face of the lap is when the plates are accidentally damaged

Versatility Features Design Of H. O. Bates "AcromarkeR"

The "AcromarkeR" name plate stamping machine offered by H. O. Bates (AcromarK Co.), 245 N. Broad St., Elizabeth, N. J, is adapted to stamping complete name plates from metal strip and to filling in serial numbers, specifications and other information into etched, embossed, cast and other types of metal, fiber or plastic plates. Holding fixture receives a plate up to 8 x 4¾ in, and permits stamping within an area of



5 in. left to right by 3¼ in. top to bottom, up to ⅝ in thick

Die wheel rotates on double row SKF precision roller bearings. It has a positive stop for positioning each character. Machine table can be advanced a full space or a fraction of space. Powerful screw pressure permits stamping of steel, stainless steel and alloy steels Dies are of heavy-duty construction, and are designed to withstand severe service Machine is finished in black and chromium

"Pix-Up" Finder and Tray Speeds Up Screw Driving

An increase of from three to nine times in the speed of power-driving screws is claimed for the Thor "Pix-Up" finder and "Adjusto-Tray" developed by Independent Pneumatic Tool Co., 610 W. Jackson Blvd, Chicago, Ill. This device, which sorts, picks up and holds screws for driving, eliminates time wasting hand operations of picking up screws by the fingers and starting or holding the screw in a tapped or drilled hole. Not magnetic, but entirely mechanical, the unit is simple in design and operation.

The unit consists of the "Adjusto-Tray", which is spring mounted on a base and adjustable by clamp screws for the length of screw to be driven. Into this tray, which has a series of slots, screws are spilled; shaking the tray a few times suspends the screws in the slots by their heads. A power screw driver equipped with the "Pix-Up" finder is then placed over a screw head and pressed. As the tray depresses slightly, the



finder grips the screw head firmly, holding it ready for driving. Finder itself is an extension type that can be fitted to any Thor power screw driver. It has three slots lengthwise which open slightly as the finder is pressed over the screw head and close on the head to hold it, acting as mechanical fingers Inside the lower end, the finder is recessed to fit the particular screw to be driven.

Bore Inspection Telescope Penetrates up to 20 Ft.

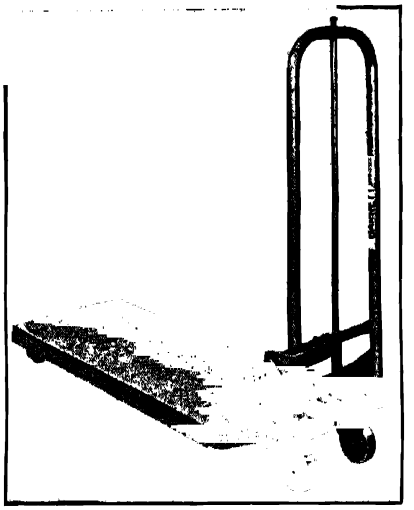
A clear and detailed view, much enlarged, of the inner walls of gun barrels, tubing, pipes, boiler tubes, and similar members up to a depth of 20½ ft is provided with the Model No M 2125 bore inspection telescope developed by Gaertner Scientific Corp, 1201 Wrightwood Ave, Chicago, Ill. Small holes, cracks, pits, scratches and other defects are readily seen Inspection can be made in tubes 1 to 4 in in diameter.

The main unit of the telescope permits inspection of tubing to a depth of 4½ ft. It consists of an illuminating head, a telescope tube containing the necessary optics, and a removable eye-piece. Extension tubes, each 4 ft. long and containing the necessary optics, can be added to the main unit to increase the depth of inspection. As many as four of these extension tubes can be added, giving a maximum usable depth of 20½ ft. The method of connecting the extensions is such as to ensure a rigid tube.

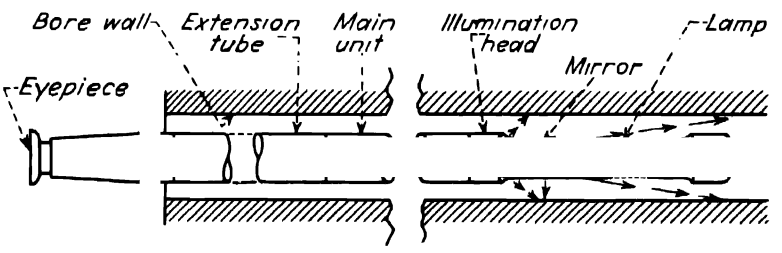
The illuminating head which carries a special tubular lamp, is provided with an adjustable inclined mirror, which enables the observer not only to look along the inner walls of the bore, but also to obtain a direct view at right angles to the wall. The image of the wall formed by the mirror appears in the center of the field of view. The view is such as would be seen were it possible to place the eye within 2 to 8 in. of the point being inspected.

Half-Ton Lift Truck Used Without Skids

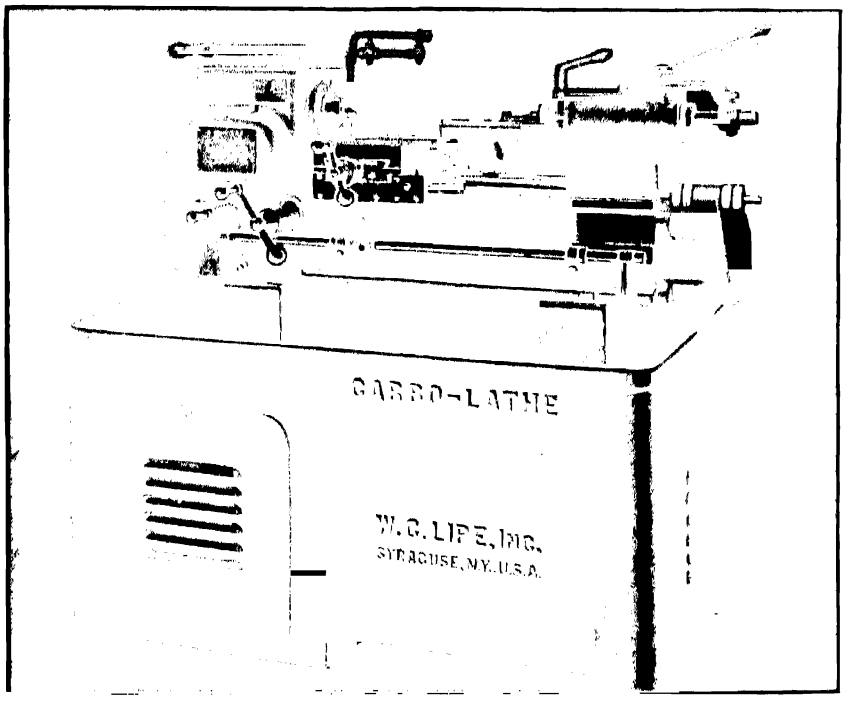
The ½-ton ball bearing lift truck offered by Barrett-Cravens Co., 3255 W. 30th St, Chicago, Ill., can be used either with or without skids



because of a sheet metal deck on the upper frame. Made in platform heights of 3½, 6, 7 and 9 in, this small truck is available only in 18 in. widths, with lifts of 2 in



Improvements in Lipe "Carbo-Lathe" Give Extra Rigidity for Heavy Work



Designed for high-production turning with modern alloy tools, the 'Carbo-Lathe" made by W C Lipe Inc 208 S Geddes St, Syracuse, N Y, incorporates improvements that add to rigidity and increase the machine's ability to take heavy cuts in tough materials at high speed without chatter or tool breakage

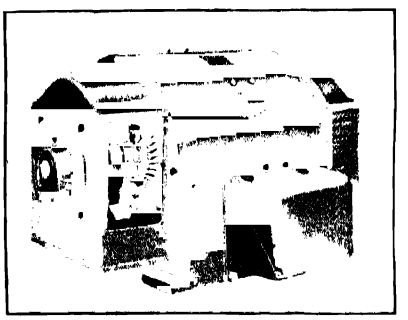
Base is a box section completely inclosing the motor and drive mechanism All controls are out of sight The motor cabinet is considerably larger to accommodate a motor as large as 10 hp, and to provide space for free air circulation and efficient motor ventilation The base also houses a coolant tank now double in capacity, and a large chip pan Recessed toe room is of sufficient height to prevent interference even when the operator stands on a platform A compartment at the end of the base gives room for storing tools and accessories Box-type construction requires no additional floor area

Size of the lathe permits 12 in swing and 18 in between centers Power is applied through worm drive Reduction of friction is obtained by mounting the spindle on two Timken bearings and by using ball bearings on the clutch pulley, clutch shaft, worm shaft, feed worm-gear shaft clutch-feed shaft, hand-feed shaft, rack pinions and feed shaft in bed

The 600-lb headstock and bed are cast in one solid piece of chrome-nickel iron A correspondingly heavy two-piece tailstock is used Tailstock quill is 3 in in diameter Its center can be operated by handwheel or lever, supplied optionally

General Electric d.c. Motors Are Safer, More Compact

Compactness and improved protection are two outstanding features of a line of d c motors announced by General Electric Co, Schenectady N Y A new design of rolled-steel frame and improvements in end-shield and bearing-bracket construction combine to give these motors better protection from external damage Use of "Formex' wire coils and a specially developed insulating varnish provides high resistance to impact, abrasion and action of foreign materials Motors can be furnished with either sleeve or ball bearings



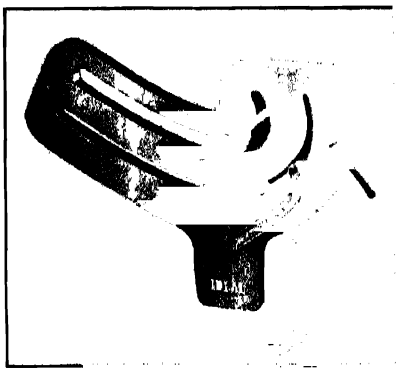
Open motors are available in constant-speed ratings from ½ hp at 850 r p m up to 60 hp at 1,750 r p m, and in adjustable-speed ratings from ½ hp at 850/3 400 r p m up to 15 hp at 500/1 800 r p m Motors in the larger ratings (beginning at 50 hp 850 r p m) embody additional design innovations such as a new system of self-ventilation, extra protection of all current-carrying and rotating parts and large conduit boxes V-type double brush-holders give better commutation and permit rotation in either direction A new type lifting lug facilitates handling

Other features common to the entire line include lower WR^2, small diameter, and reversal without changing any parts of the frame, fan, or brush rigging

"Ideal" Brush Concaver Produces Accurate Shape

It's easy to form brushes to the commutator curvature with the carbon brush concaver announced by Ideal Commutator Dresser Co, 1057 Park Ave, Sycamore, Ill With this device the old brush is used as a templet to locate the arc segment on the cutting guide slot, which corresponds to the contour of the commutator or slip ring After this segment is found the new brushes may be formed without further set-up

Any electric drill or electrical shaft drive may be used to operate the cutting head The complete unit includes aluminum guide casting, cutting file removable angle plate with clamping device and C-clamp The device takes practically any size brush for a 4 to 48-in diameter commutator



Midget Toggle Plier Devised for Aircraft Work

Knu-Vise, Inc, 16841 Hamilton Ave, Detroit, Mich, has developed a midget toggle plier especially for use in the aircraft industry Over-all length of this tool is only 3 in, and

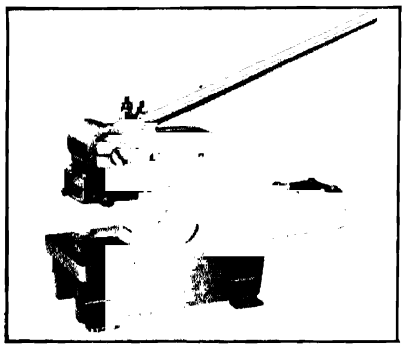


weight is only 3 oz. Made from SAE 1029 steel, hardened and tempered, it provides a leverage of more than 90:1, thus enabling the operator to grip small parts with a pressure in excess of that obtained with the small conventional C-clamp

Leslie Hand Punch Press Maintains Positive Alignment

The hand-operated punch press built by Leslie Welding Co., 2943 Carroll Ave., Chicago, Ill., is claimed to incorporate the accuracy of a leader pin die set, although it has no ram, ways nor slides Register of punches and dies is maintained by a leaf arm which is rigid except at its flexing point. Because of this construction, coupled with an unduly wide bearing of the operating eccentric, it is said to be unnecessary to center the load on the punch plate.

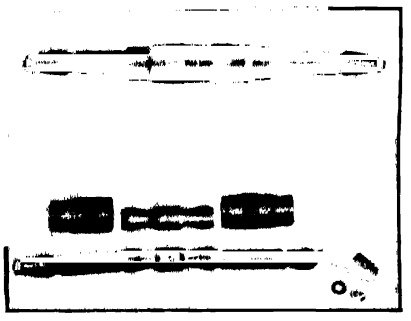
The press is especially adapted to blanking and punching small stampings and punching along the edges of



large sheets Punch plate measures 4 x 4¼ in. and is designed to accommodate most blanking punches ordinarily used on small power presses Clearance from punch plate center to frame is 6 in. Stroke is $\frac{7}{16}$ in., with a stroke adjustment of ⅛ in. Press has a capacity for punching through 14 gage mild steel or 16 gage 18-8 stainless steel.

Welding Cable Connectors Lock Conductors Together

Joints in arc welding cables are securely locked together with the insulated cable connectors offered by Jackson Electrode Holder Co., 6553 Woodward Ave, Detroit, Mich. The



device provides a positive and quick method of connecting various lengths of arc welding cable

To apply, about 1½ in. of insulation is stripped from the end of the cable. The fine wires are spread enough to insert the coned head of the connector bolt and a copper sleeve and lock washer slipped on. The nut is screwed down as tight as possible to clamp the cable strands against the inside wall of the sleeve and provide copper-to-copper conductivity The same process is repeated with the other cable end, both sleeves are placed in the copper shells, and the insulated housings are slipped on and screwed together. A red insulator housing identifies the positive connector; black, negative.

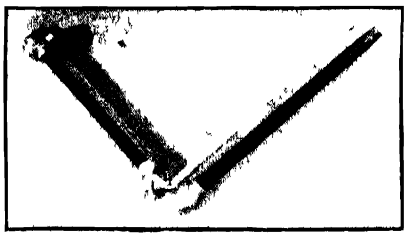


Steel Carrying Case Protects Hand Grinders

To keep its No. 8 and 10 hand grinders free from shop dirt and to prevent them from being misplaced, Dumore Co, Racine, Wis., has developed a sturdy steel carrying case. This case measures 11x4¼x3¼ in and also contains a compartment for storing extra grinding wheels, abrasive bands and arbors.

L&N Thermocouple Fitting Makes Replacement Easier

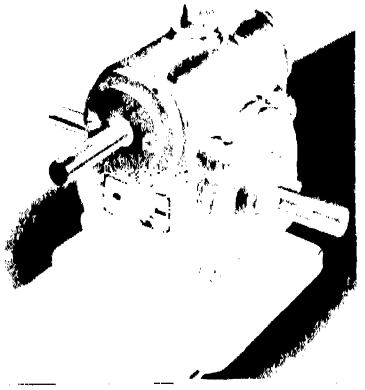
To facilitate thermocouple replacement, a universal union for angle-type couples has been adopted by Leeds & Northrup Co., 4934 Stenton



Ave, Philadelphia, Pa. The two halves of this union fit snugly together in a ground joint making it vapor- and fume-tight. By unscrewing a single clamping nut the thermocouple's hot leg can be detached; or it can be rotated to any angle between 90 and 180 deg. and locked firmly in place.

Worm Gear Speed Reducer Transmits Light Loads

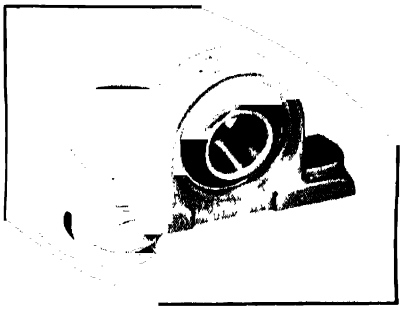
The No. 3½ BT worm gear speed reducer has been designed by Winfield H. Smith, Inc., Springville, N. Y., for efficient speed reduction in frac-



tional horsepower applications. Said to be of high quality construction throughout, this worm-on-top reducer embodies a worm of hardened steel with ground threads keyed to the shaft which is mounted on radial thrust type ball bearings. Gears are of special alloy bearing bronze. Built-in oil seals are provided at all shaft extensions. Ratios of 58, 36, 18 and 9 to 1 are available, in the ¼-hp rating with a torque capacity up to 190 in-lb Unit measures 6½ in high, 4⅛ in. wide and 5 in. long Weight is about 16 lb

"Mechani-Seal" Ball Bearings Used in Transmission Units

Fafnir Bearing Co, New Britain, Conn., has developed a series of pillow blocks and other transmission



units incorporating "Mechani-Seal" ball bearings. The light series pillow blocks, flange cartridges and cylindrical cartridges offer two outstanding advantages, for in addition to the efficiency of the seal construction, they offer the ease of application made possible by a wide inner ring design with self-locking collar. They are locked to the shaft with a finger-twist. No machining, adapters or lock nuts are required.

The "Mechani-Seal" bearing, em-

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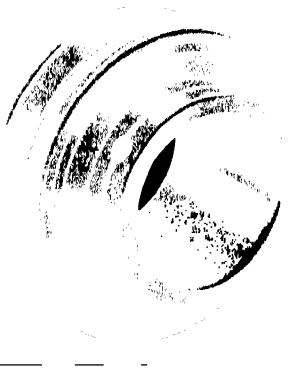
2049 EAST SIX TY-FIRST PLACE

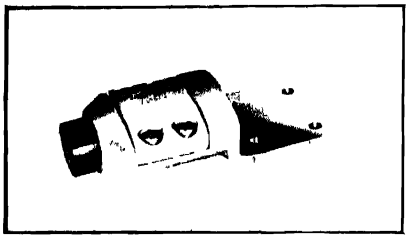
CLEVELAND 2, OHIO

ploying close tolerances rather than rubbing material for its efficiency, imposes no extra friction or drag Two steel plate shields form the innermost members. They are tightly fitted to the bearing outer ring. An outer corrosion-proofed steel plate shield, pressed on the inner ring, clears these inner plates by definite but close tolerances, and acts as an efficient slinger.

"Sealmaster" Ball Bearings Have Extended Inner Rings

Extended inner rings are provided in the Style A "Sealmaster" ball bearing units developed by Stephens-Adamson Mfg. Co., Aurora, Ill. For machine application on straight shafts, these bearings employ a centrifugal labyrinth seal, eliminating the necessity for seals in the housing. Annular grease groove with two holes permits regreasing. Bearing is fitted with a snap ring to permit through bore of the housing. It is available for shaft sizes from ⅝ to 2⅛ in.





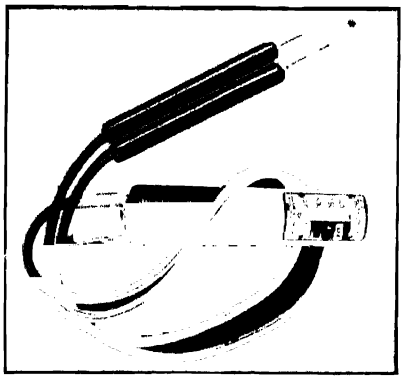
"Streamlined" Terminal Designed for Easy Taping

Type SNA-H "Streamlined" cable terminal offered by Burndy Engineering Co., 459 E. 133rd St., New York, N. Y., has been designed to facilitate easy taping of the connector and to help insure a moisture-proof seal to the insulation. A recess at the cable entrance permits the end of the cable insulation to be inserted into the connector, thus shrouding and protecting the insulation. This connector is also made with hexagon head cap screws set in recesses in the cap in such a way that they can be easily tightened with an ordinary socket wrench.

Square D Voltage Tester Permits Easier Readings

Use of different colored bands for each alternating current voltage, together with increased pointer travel at higher voltages, makes possible easier readings with the No. 5000 voltage tester offered by Square D Co., Detroit, Mich. In this improved instrument alternating current is distinguished from direct current by vibration of the pointer, which is flush with the outside of the case to prevent injury. Operating mechanism has been strengthened and improved to provide greater accuracy.

Long, rubber-covered lead wires are fitted with hooks and with sharp points for piercing wire insulation without damage. Steel strands in the wires make the leads capable of resisting considerable strain without breaking. Fiber handles insulate the leads, which are armored at the entrance to the case to prevent wear or breakage.



Kux-Lohner Hand Ladling Die Caster Molds Parts from Aluminum or Brass

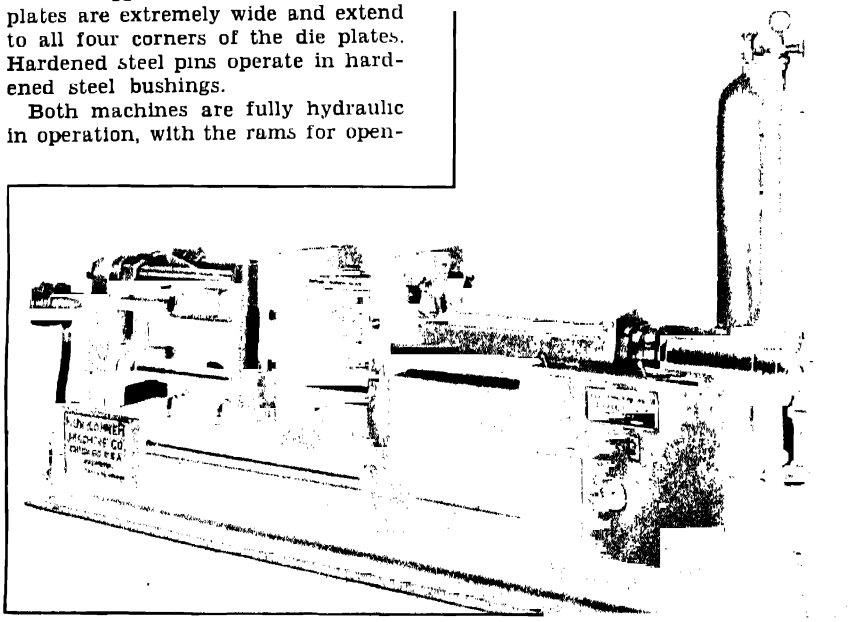
Die castings of either aluminum or brass alloys can be produced with the high-pressure type die-casting machines developed by Kux-Lohner Machine Co., 2145-47 Lexington St., Chicago, Ill. Built in two sizes, these machines are of the hand-ladling type in which the molten metal is poured from a crucible into a well at the back of the stationary die half, and from there injected into the die under pressure up to 10,000 lb. per sq. in.

On the Model HP-12 machine, die space between bars is 12 in. square. On the No. HP-18 model, die space is 18 in. square. Castings weighing up to 7 lb. in brass and 2½ lb. in aluminum can be made.

Machines are massively built to withstand both high injection and die locking pressures. All parts subjected to wear are made of heat-treated alloy steels. Dies are opened and closed by a powerful toggle arrangement. Toggle bearings on the die plates are extremely wide and extend to all four corners of the die plates. Hardened steel pins operate in hardened steel bushings.

Both machines are fully hydraulic in operation, with the rams for opening and closing the dies and injecting the metal all operated from a central motor driven hydraulic pump mounted on an oil storage tank. Only one operator is required. Machines are built close to the floor to facilitate ladling. The ladling well is approximately table height, with no interfering members around it.

Incorporated in these machines are safety features whereby each phase of the casting cycle must be operated in the proper sequence and each cycle completed before the next one can start. An electric timing device controls the solidifying period. Operation of two hand levers, one controlling the die opening and closing, the second controlling the injection plunger, puts the machine through its complete cycle. A gas accumulator bottle charged with nitrogen is provided to intensify speed of the shot.



Non-Slip Floor Wax Makes Use of Neoprene

Flexrock Co., Dept. AM, 2300 Manning St., Philadelphia, Pa., has developed a non-slip floor wax embodying du Pont Neoprene. Use of this synthetic rubber is claimed to provide longer life and greater resistance to abrasion and heat.

General Electric Galvanometer Provides Extreme Sensitivity

A galvanometer more than three times as sensitive as previous ones has been introduced by General Electric Co., Schenectady, N. Y. This instrument is said to be suitable for many applications where wall types were heretofore frequently necessary. Applications include temporary setups for factory and laboratory testing and permanent installations for testing instruments, material, and production apparatus where rapid readings and minimum operator fatigue are essential. Extreme sensitivity is obtained by two fixed mirrors inside the case, which increase the effective light beam length.

Galvanometer element and optical systems are mounted in sturdy cast aluminum alloy case. Translucent scale is double-marked 50–0–50 and 0–100 in 1-mm. divisions. Light is provided by an easily replaceable automobile-type lamp, which provides a high-intensity spot with hairline index, so that the scale can be read quickly, accurately, and with minimum fatigue. An external adjuster is provided for setting the element.

"Colorflex" Floor Dye Made Fire, Acid and Alkali Resistant

"Colorflex", an enamel-like floor dye, offered by Flexrock Co., 2300 Manning St., Philadelphia, Pa., has been improved to make it resistant to fire, acids and alkali. It is claimed that a match can be applied to the surface without the gloss being injured. It is likewise claimed that the surface is unaffected by either concentrated or dilute sulphuric or carbolic acids.

"Vanite" Polishing Grain Made Under Rigid Control

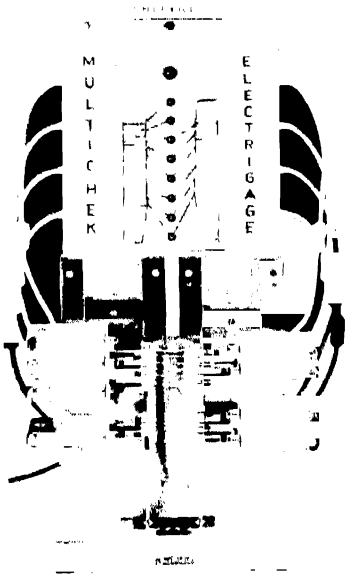
An advantage of "Vanite," a fused aluminum oxide polish grain developed by Hanson-Van Winkle-Munning Co., Matawan, N. J., is the rigid manufacturing control to produce consistent uniformity from keg to keg and from month to month as regards size, shape and chemical composition of the grain. The grain is a product of Bauxite, from which all impurities such as a titanium oxide, iron oxide, silicate, etc., have been removed.

Grains are of the "blocky" type, as nearly equi-dimensional as possible and practically free from weak par-



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Unless every one of the eight critical dimensions of this 75 mm. shell checks within prescribed limits, it does not pass this guardian of quality. Six hundred an hour of these shell bodies are thus checked on the Sheffield Multichek Electrigage pictured at the left. In a flash the inspector knows whether each shell body is acceptable or not.



The slightest variation beyond tolerance limits is flashed by a colored signal light on the control board above the Electrigage head. The color of the light indicates whether the dimension is oversize or undersize. And the position of the colored flash indicates just which dimension or dimensions are incorrect. If all dimensions are correct the master signal at the top of the board so indicates. Then it is unnecessary to read individual signals.

If your problem is rapid, accurate inspection of multiple dimensions on a wide variety of parts without eye strain, write for particulars on the Sheffield Multichek Electrigage.

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ticles which have inferior abrasive value. Its high capillarity makes the compound especially suitable for use with adhesives. It is said to make possible the production of a strong wheel head which will give maximum polishing performance and economy.

M.S.A. "Comfo" Respirator Protects Against Metal Fumes

For protection against fumes of metals, such as those generated when burning, pouring or molding lead, cadmium, zinc, etc., the "Comfo" respirator has been developed by Mine Safety Appliances Co., Braddock, Thomas & Meade Sts., Pittsburgh, Pa. Approved by the U. S Bureau of Mines, this unit provides complete working freedom and permits use of goggles or other headgear without interference.

Construction features include filters of unique design, having high filtering efficiency against fine metal

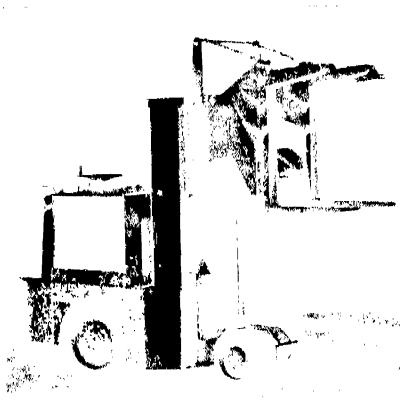


fumes; filter area more than double that of regular dust filters; aluminum filter containers, assuring long filter life by keeping out grease and dirt; all-rubber facepiece which fits any face snugly and comfortably; and foolproof U. S. Army type exhalation valve.

Mercury Ford Truck Handles Sheet Metal

Mercury Mfg. Co., 4118 S. Halsted St., Chicago, Ill., has devised a fork truck with automatic clamps for handling tin plate and loose stacks of sheet metal. Designated as the Model A-2440, this truck is a two-wheel drive, four-wheel steer machine with horizontal steering wheel

The truck, having a capacity of 4,000 lb., loads up to 36 in. in length. It is driven through a heavy duty double reduction axle. Travel controller is of the double unit mechanical contactor type, providing four



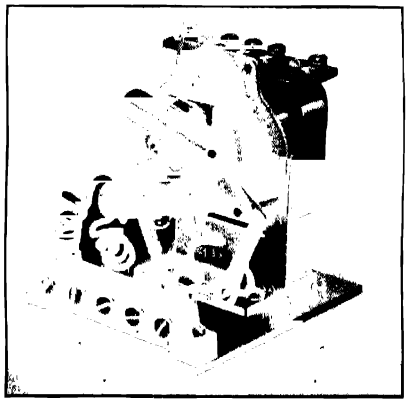
speeds in both directions and having separate handles for travel direction and speed selection.

Hoist mechanism is the conventional Mercury hydraulic type. Fork lift and over-all height are subject to variation to meet specific requirements.

Chattering Eliminated by Barber-Colman "Motorelay"

Consisting of a small reversible geared-head "Barcol" motor which tilts two mercury tubes, the "Motorelay" offered by Barber-Colman Co., Rockford, Ill., permits throttling, floating, or proportioning control of a 5-amp load from a sensitive instrument having a current rating as low as 0.35 amp. Chattering is eliminated because a momentary contact at the instrument is not sufficient to close the mercury tube switch.

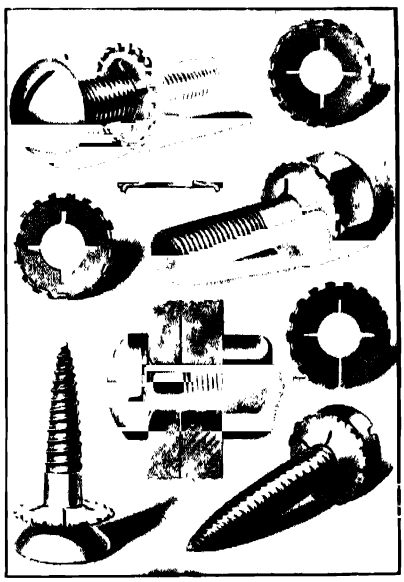
Tubes are arranged to give single pole, double throw operation, with spring return to a neutral "off" posi-



tion. The switch is particularly suited to floating or proportioning control of line voltage motors operating large dampers, valves, speed adjusters, voltage regulators and similar equipment.

"Pre-Fixed" Lock Washer Assembled With Press

The "Pre-Fixed" lock washer designed by Mechanical Laboratories, Inc., 128–130 Latham St., Pittsburgh, Pa., is assembled to a standard threaded fastener before leaving the factory by a simple press operation, without the necessity of any special operations in the manufacture of screw or washer. Washer itself resembles a standard lock washer, with radial slots extending outward from the central hole. This hole is slightly smaller than the screw thread diam-



eter. Dimensions are such that the washer is assembled merely by pressing it over the thread.

"Kollag" Graphite Lubricant Permits Use of Cheaper Oils

It is claimed that less viscous and generally cheaper oils can be used satisfactorily in combination with "Kollag" graphite lubricant offered by Pfaltz & Bauer, Inc., Empire State Bldg., New York, N. Y. This colloidal graphite, suspended in a specially selected type of lubricating oil, is said to have a purity of 99.8 per cent. It is intended to effect oil economy, save power, reduce friction and minimize wear.

Goodrich V-Belt Prevents Static Electricity Accumulation

What is believed to be the first V-belt ever made which prevents accumulation of static electricity and retains its static-discharging qualities throughout its entire service life has been announced by B. F. Goodrich Co., Akron, Ohio. This V-belt will be sold, for the present, only to machine and equipment makers. This improvement is expected to be of great importance in machinery design for applications where a static discharge might create a fire hazard.

Another important feature of the belt is the absence of any danger of the belt acting as a short between the motor and its operator. Resistance built into the belt is just enough so that the belt itself cannot act as a direct conductor of current.

Four Lighting Fixtures Announced by Wiremold

The Wiremold Co., Hartford, Conn., has made available a line of wired and unwired fluorescent units, and two new complete related "Plugmold" multiple outlet systems. The fluorescent units are available in unit lengths for any specified size and number of lamps, with or without reflectors of either concentrating or diffusing types. Special controls designed to fit within the channel make a completely self-contained installation.

The smaller No. 1900 "Plugmold" mutiple outlet system has a capacity of two wires for single circuits. The large No. 2100 system has a capacity of 6 wires, for switch-controlled circuits and where fluorescent lighting is combined with outlet installations.

Line of Machinists' Tools Introduced by George Scherr

George Scherr Co., 128 Lafayette St., New York, N. Y., has brought out its own line of "GS" machinists' tools. The line consists of a combination set with drop forged hardened square heads, hardened center head, hardened blade and reversible protractor head; a combination set with hardened blade and center head, protractor and square head of cast iron: 4, 6 and 8 in dividers; 4, 6 and 8 in. inside and outside spring calipers; hardened and tempered center gages; thickness gages; depth gages; surface gages and magnifiers. Hook, sliding caliper, flexible and narrow tempered rules are also included in this line.

"Glasflex" Floor Finish Resists Fire, Acid, Alkali

Flexrock Co., Dept. AM, 2300 Manning St., Philadelphia, Pa. has improved its "Glasflex" transparent floor covering so that it is claimed to be totally resistant to acid and alkali. It is said that this material can be submerged in concentrated sulphuric acid, dilute sulphuric acid, carbolic acid, sodium hydroxide solution, soaked in alcohol and ignited without the gloss being affected.

"Paratex" Floor Coating Has Chlorinated Rubber Base

Many disadvantages of linseed oil base floor coverings are claimed to be eliminated in the "Paratex" coating for concrete and wood floors developed by Truscon Laboratories, Box 69, Milwaukee Junction P. O., Detroit, Mich. This paint is said to flow easily and brush out smoothly, so that the average painter can apply it readily.

When drying conditions are good, "Paratex" will dry hard enough to walk on in a few hours. It will be oil and grease-proof in 24 hours, and resistant to most chemicals in 48 hours. It is claimed to be unaffected by sunlight. Six colors are available.

Correction—Fell Level

The "All-Way" precision level introduced by William B. Fell Co., 700 South St., Rockford, Ill., (*AM*—Vol. 84, page 897) while easily read to 0.00025 in., also shows 0.005 in. per ft., instead of only 0.0005 in. per ft., as previously stated.

NEW MATERIALS

Laminated Shim Stock Marked for Convenience

Thin shim stock supplied in slotted cartons by Laminated Shim Co., Glenbrook, Conn., now is furnished plainly marked in inches on its edge. Markings run from 0 to 100 in., with half-inch subdivisions throughout the 100 in. length. Thus the metal can be conveniently pulled through the carton slot and cut off to exact size. Not only is waste avoided but the markings also indicate when the roll is almost used up These packaged rolls of 6-in wide brass or steel shim stock are available in thicknesses of 0.001 to 0.015 in.

Wear-Resistant Steel Can Be Easily Welded

A tough, austenetic non-magnetic steel alloy which combines abrasion-resistant properties with weldability without subsequent heat-treatment has been made available by Jos. T. Ryerson & Son, Inc., 16th & Rockwell Sts., Chicago, Ill. Known as "Manganal," this alloy contains from 11 to 13½ per cent manganese and 3½ per cent nickel—the nickel content permitting the material to be welded without a subsequent quenching, as there is no loss in toughness when cooled from welding temperatures. This is said to make a reasonable structural material of a composition that would otherwise be difficult to handle. Welding rods are 18–8 stainless composition have been found to give very satisfactory results with "Manganal."

The alloy is claimed to have all the advantages of 11-14 per cent manganese in resistance to wear and work hardening. Thicknesses up to ½ in. can be sheared. Plates can be flame-cut, requiring no subsequent treatment when formed or punched hot. Physical properties include a tensile strength of 140,000-150,000 lb. per sq. in.; elastic limit of 55,000–60,000 lb. per sq. in., elongation in 2 in. of 72½ per cent; and a reduction of area of 54 per cent.



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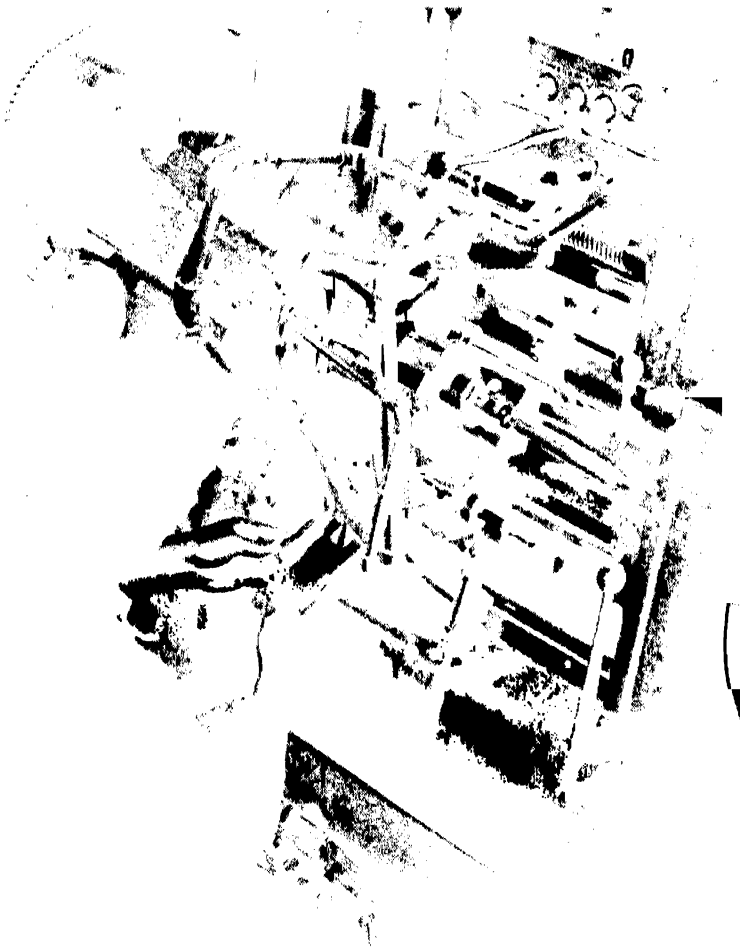
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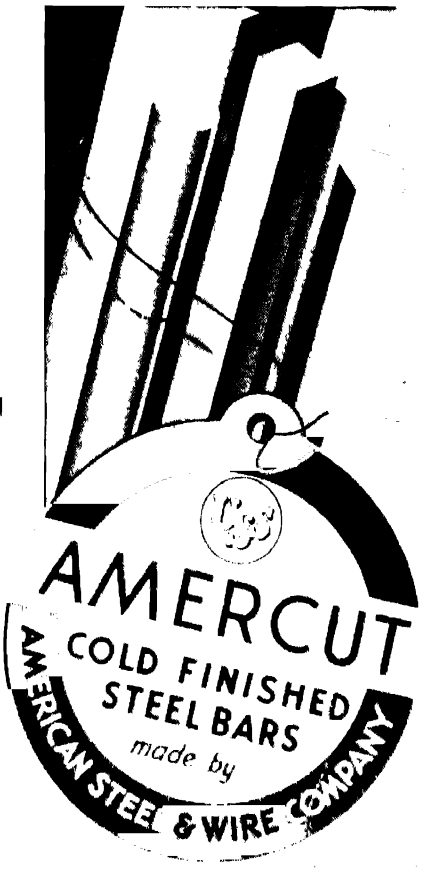
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RULE No. 1 for getting best results from high-speed machines is to use AMERCUT Cold Finished Steel Bars. This product is available in a wide range of carbon steels and alloys which can be machined into an amazing variety of parts. The AMERCUT tag on the bars you buy assures you of a product that meets the highest standards of quality. The uniformity of these bars will save you money in reduced wear on tools and in faultless production of parts in many sizes and shapes that are accurate in all dimensions.

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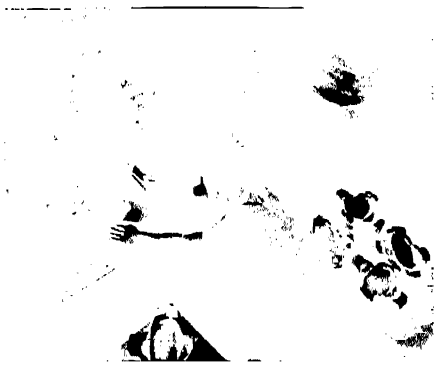
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UNITED STATES STEEL

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MAJOR ARTICLES

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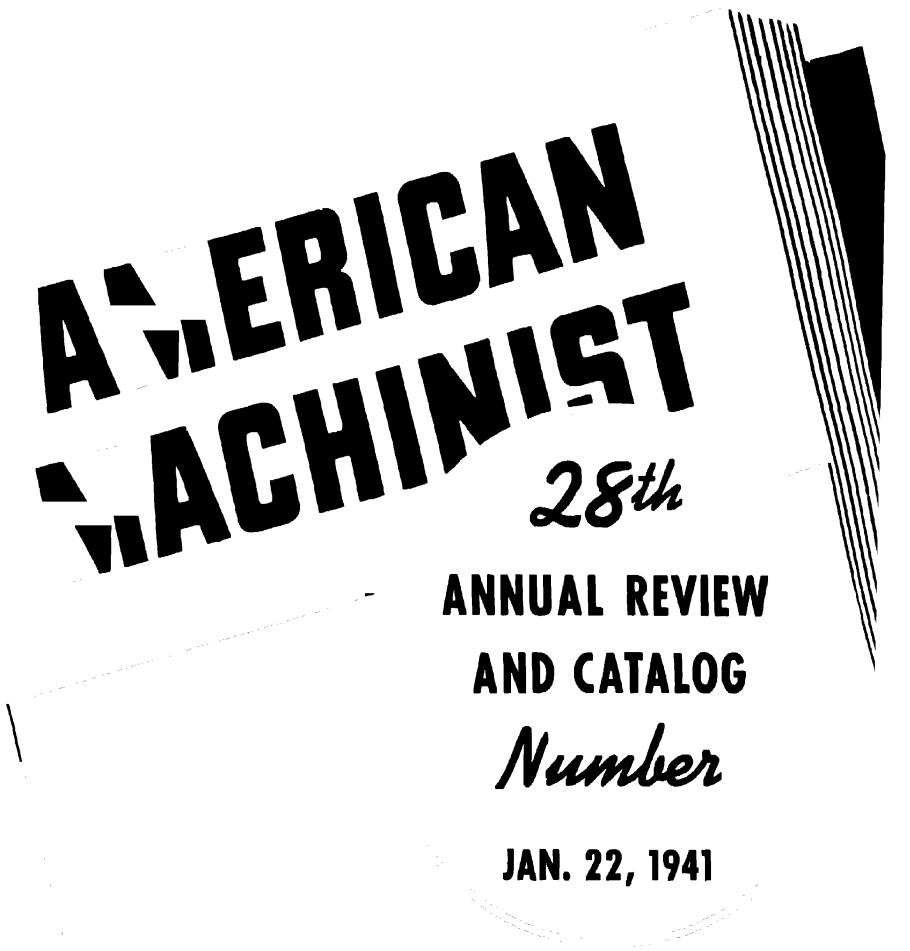
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WHAT'S IN THIS ISSUE

ENORMOUS NAVY

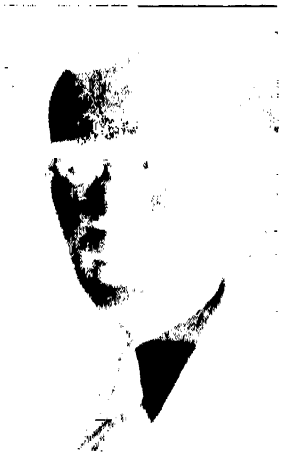
You first hear about it when Congress begins to wrangle over it. You follow hot debates, take sides, become vastly relieved when a "two-ocean Navy" bill is passed. Then the papers forget all about it, as if the new ships were already launched, and get steamed up over something else. Maybe you do too.

No metal-working man needs to be reminded that it's years—two, three, four—from the appropriation to the finished ship, yet many of us lose sight of this fact. Acres of blueprints must be made. Reams of orders must be sent. Tons of complete assemblies must be manufactured. Materials requisitioned. Production planned. And so on.

One major ship component requiring considerable time to produce is the propulsion unit. Last month we reported on the manufacture of turbine gear reduction sets, and in this issue we describe one of the most important considerations in turning out the turbines themselves—the tooling. Beginning on page 1015 is a thirteen-page article on the tooling set-ups used in the New York Navy Yard for various turbine-making operations. It's in the Armament Section, of course.

OUNCE OF PREVENTION

We have long subscribed to the school of thought that maintains (to coin a phrase) that an ounce of prevention, etc. We don't seem to get very far spreading this particular gospel, but we've found one ardent supporter in A. H. Prey, of the Carborundum Company. Mr. Prey feels, among other things, that it's quicker and cheaper to sharpen cutters *before* they get dull. For further details, consult "Tips for the Cutter Grinder." It's on page 1004.



A. H. PREY
. . . *before, not after*

HIGHER

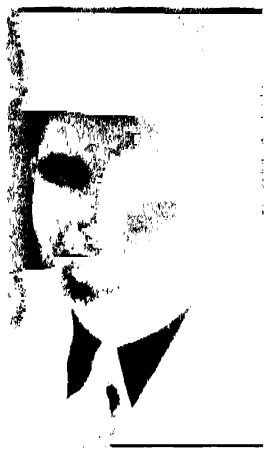
Higher production with higher accuracy is no new problem to aircraft people, but their individual solutions often exemplify an approach that can be used profitably elsewhere. Such is the case at Bendix Aviation, where the usual task of boosting output of small-lot parts held to close tolerances was accomplished by construction of special equipment. A down-to-fundamentals approach, and a knack for simplicity, resulted in additional advantages as well. Walter M. Schindler, Bendix production engineer, gives the details on page 1029



W. M. SCHINDLER
. . . *new aid for aircraft*

ABOUT ALUMINUM

Two weeks ago we introduced to you L. J. Weber and J. T. Weinzierl, of the Aluminum Company of America, with the promise that they would soon begin a series on the cold working of sheet aluminum. A mere turn of the page brings you to the first article in this series. In it the authors outline general characteristics of aluminum and its more common alloys, and discuss heat-treatments for various methods and degrees of working.



E. JAMES
. . . *works with welding*

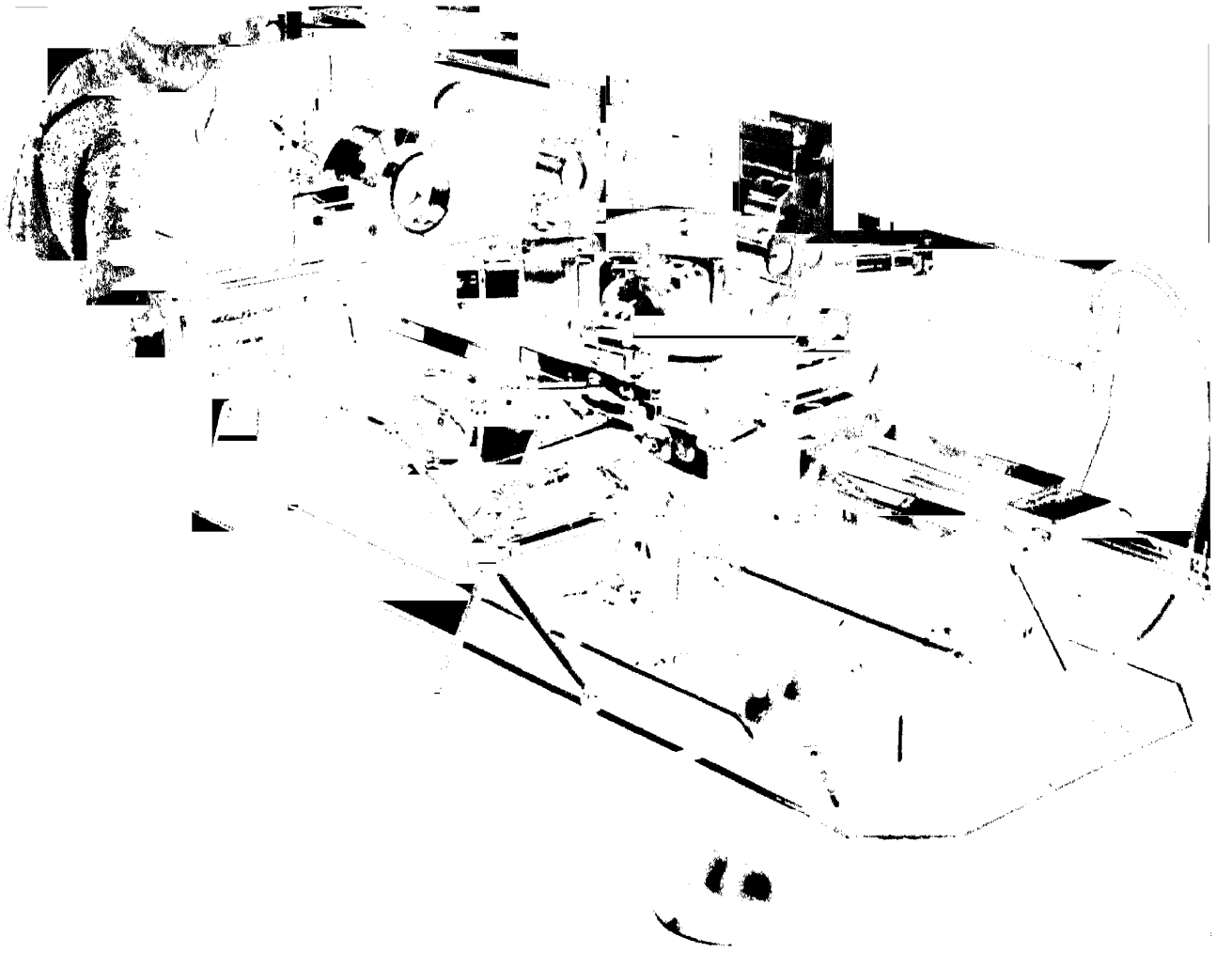
There'll be five more installments in the series, all as jammed with information as this one, so we respectfully suggest you start it now.

CAREER

Since 1926 E. James has been involved with welding operations on automobile body and chassis parts. He was a tool designer for Hudson, later tool engineer. He moved on to Briggs, then became a tool engineer for Budd. At Ford he worked in the body engineering section. At Packard he was first in charge of the die shop and model production, then fixture design and building. He has since taken over full responsibility for design and building of welding fixtures. Anticlimatic or not, he has also written an excellent article on the resistance welding of heavy sections, which you'll find on page 1008 of this number.

COMING

What's going on in Canada? What is the Dominion doing toward supplying Britain with vital war equipment and supplies? In our next issue we'll take you inside several Canadian munitions plants and reveal how ammunition and gun parts are produced. In an expanded Armament Section will be detailed many of the more important metal-working operations, complete with descriptions of much of the tooling. Look for the December 25 AMERICAN MACHINIST!





CINCINNATI ACME

Versatility and Accurac
For Aircraft Turning Jo

At the Pratt & Whitney Aircraft plant, the Cincinnati Acme Universal Turret Lathe shown above is performing four operations on steel liners for one of the large main bearings of Pratt & Whitney Radial Engines. Turning, boring, facing and chamfering are done on the part in this one set-up.

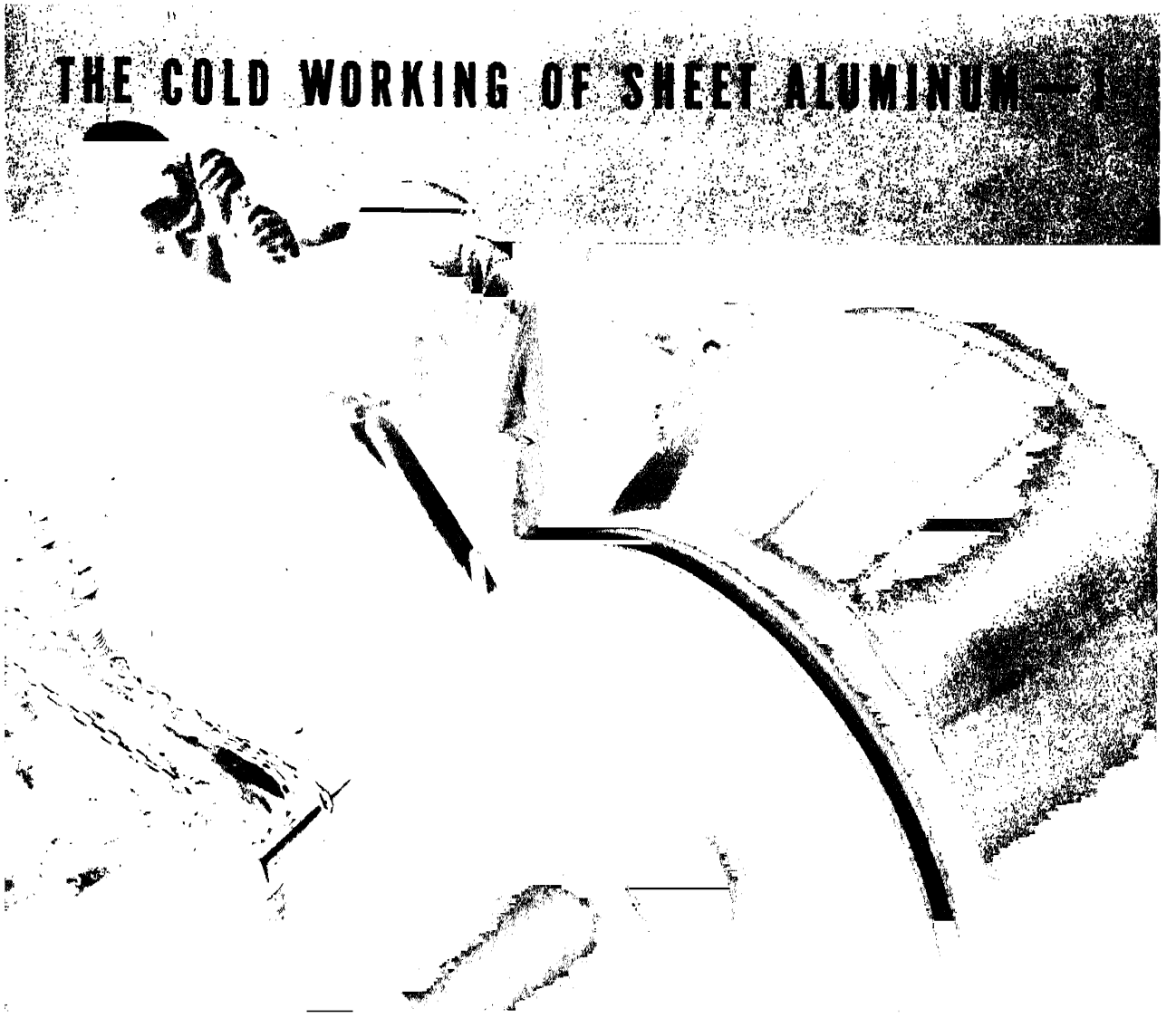
Cincinnati Acme Universal Turre Lathes are chosen by aircraft manu facturers for Accuracy — to mee the rigid specifications of the indus try. . . . Versatility—to handle lon or short runs on a wide variety c parts. . . . Speed—for profitable hig production and for maximum effi ciency with carbide and similar tools

Write for engineering suggestions on any problem of Turret Lathe production.

THE CINCINNATI MACHINE TOOL C
CINCINNATI, OHIO

ESTABLISHED 1877 **AMERICAN MACHINIST** BURNHAM FINNEY, Editor

THE COLD WORKING OF SHEET ALUMINUM—I



Two men with a hickory stick here are spinning a large aluminum-alloy container for an industrial plant. This process is important where production requirements are low

Available alloys

BY L. J. WEBER AND J. T. WEINZIERL, ALUMINUM COMPANY OF AMERICA

From a laboratory curiosity to a vital structural material—That's the story of aluminum. Much data for cold working its alloys is given in this series

ALUMINUM is one of the most workable of the common commercial metals. Available in all forms in which metals are produced, it is readily fabricated into a variety of shapes by practically every metal-working process. However, the metal-worker should not think of aluminum as just one material, but rather as a series of alloys which come in a wide range of tempers. The characteristics of these alloys affect shop practices and should be thoroughly understood.

While much is known about these alloys and the metallurgy of aluminum may be called a science, metal-working is more in the nature of an art. Especially is this true in the case

of spinning where the "feel" of the spinner is highly important and the spirit of the artisan is much alive.

Whenever aluminum or any other metal is worked cold—whether in making a basic commodity, such as sheet, or in later fabricating operations—strain hardening takes place. During the manipulation of the metal, the tensile and yield strengths are increased and the elongation is lowered. How these mechanical properties vary for the various tempers in the different alloys is shown in Table I.

The three properties mentioned serve as an indication, though not as an absolute measure, of the workability or formability of the material. Unlike mild steel, aluminum and other non-ferrous alloys do not have a yield point; that is, there is not a stress at which the metal deforms plastically without any increase in the stress. However, after a certain stress has been applied, the metal does cease to deform in direct proportion to the amount of stressing, and if the load is then removed the metal will be found to have taken a permanent set. Increasing the stress increases the amount of the permanent deformation.

For purposes of design, the unit stress which produces a permanent set of 0.2 per cent of the original dimensions is defined as the yield strength. If there is a considerable range between yield strength and tensile strength, the metal is usually easier to work than if this range is small. Then, too, if elongation is high, the metal is naturally easier to form.

Index to Formability

In choosing the proper temper to use, theses properties should all be considered. However, while they are an *index* to formability, the actual ability of the material to be readily worked should be based on its performance on the tools to be used in production. This is the true test which includes all factors.

Commercially pure aluminum, known as 2S*, is particularly noted for the ease with which it can be drawn, spun, stamped and otherwise formed. In fact, starting with a blank in the annealed temper, it may be taken through successive drawing and spinning operations with no need for intermediate annealing.

The alloys of aluminum are less ductile than the pure metal, and they offer a wide range of fabricating qualities in their various tempers. On one hand, an aluminum-manganese alloy (known as 3S) is only slightly less easily formed than pure aluminum. On the other hand, some alloys permit but a minimum of forming in their harder tempers. None of the alloys lends itself to as much forming as pure aluminum, and all of them require more liberal radii.

Two Groups of Alloys

The wrought alloys, from which sheet aluminum is rolled, are of two types. In one, comprising the so-called common alloys, the harder tempers are produced by strain hardening—that is, by cold working. In another type, known as heat-treatable alloys, the mechanical properties are increased by thermal treatments.

The common alloys, such as 2S, 3S, and 52S, cover a wide range of properties. Since these alloys strain-harden as they are formed, the greater amount of work can be done on them if the softer tempers are used as a starting point. Many drawing operations, however, can be done in the half-hard temper, and the less severe draws may be made in the full-hard temper. The temper is designated as "*O*" for annealed or dead-soft, "*H*" for full hard, and "$\frac{1}{4}H$," "$\frac{1}{2}H$" and "$\frac{3}{4}H$" for intermediate degree of hardness.

While the common aluminum alloys are suitable for a greater number of products, structures such as airplanes, bridge floor systems, dragline booms, and shovel dippers require the higher strengths of the heat-treatable alloys. Among these alloys are 17S and 24S, which are of the duralumin type, as well as 53S, 61S and others.

The fully heat-treated temper of these alloys is designated by the letter "*T*." An intermediate (as-quenched) temper of some alloys, including 53S and 61S, is known as "*W*."

Heat-Treated Alloys

The most widely used heat-treated aluminum alloy is 17S. Both 17S and 24S, now the principal material used in airplane construction, lend themselves to a considerable amount of forming in the heat-treated temper. The more severe operations in these alloys have to be done in the annealed temper, and the part later heat-treated. However, the forming often may be done immediately after the metal has been quenched from the heat-treating temperature, so that the age-hardening takes place after the metal has

Table I—TYPICAL MECHANICAL PROPERTIES OF ALUMINUM ALLOY SHEET

Alloy and Temper	*Ultimate Strength (lb. per sq. in.)*	*Yield Strength* (lb. per sq. in.)*	*Elongation, per cent in 2 inches (1/16-in. specimen)*	*Brinell Hardness (500 kg., 10 mm. ball)*
2S O	13,000	5,000	35	23
2S–¼H	15,000	13,000	12	28
2S–½H	17,000	14,000	9	32
2S–H	24,000	21,000	5	44
3S–O	16,000	6,000	30	28
3S–¼H	18,000	15,000	10	35
3S–½H	21,000	18,000	8	40
3S–H	29,000	25,000	4	55
52S–O	29,000	14,000	25	45
52S–¼H	34,000	26,000	12	62
52S–½H	37,000	29,000	10	67
52S–H	41,000	36,000	7	85
17S–O	26,000	10,000	20	45
17S–T	60,000	37,000	20	100
17S–RT†	65,000	47,000	13	110
24S–O	26,000	10,000	20	42
24S–T	68,000	44,000	19	105
24S–RT†	70,000	55,000	13	116
53S–O	16,000	7,000	25	26
53S–W	33,000	20,000	22	65
53S–T	39,000	33,000	14	80
61S–O	18,000	8,000	22	30
61S–W	35,000	21,000	22	65
61S–T	45,000	39,000	12	95

* Offset 0.2 per cent.
† Temper resulting from additional cold working after heat-treatment.

* These alloy designations are those applied to aluminum alloys produced by Aluminum Company of America under the Alcoa trademark.



This 450-ton double-action toggle press is set up to "cap" the top half of a 15½-gal. aluminum-alloy beer barrel

been formed to the desired shape rather than before. This practice makes it unnecessary to heat-treat the finished article, which may be difficult to handle. It also eliminates the need for correcting distortion, which usually occurs during heat-treating, particularly during quenching.

Alloy 53S is readily formed; and 61S has even better forming characteristics, even though its tensile and yield strengths exceed those of 53S. Alloy 61S can be bent around smaller radii than 53S and takes more severe deformation. Both these alloys age-harden after forming in the as-quenched temper, and thus develop higher strengths. There is no appreciable distortion or change in dimensions during this aging treatment.

A review of Table I will show that a wide range of tempers in commercially pure aluminum and in the aluminum alloys is available for mild forming operations. For the more severe operations, however, the choice may have to be limited to the dead-soft temper.

Selection of an alloy depends upon other factors, of course, than just its formability. Some products are exposed to marine atmospheres and will have to be made from an alloy such as 52S and 53S. Others, such as containers for transporting chemicals, must not only resist the corrosive influences of the chemical, but must have adequate strength to withstand handling. In such a case, the choice of alloy is limited both by mechanical and chemical considerations. The choice of temper is then made so that, after fabrication, the finally shaped product will have the necessary strength.

Table II—NOMINAL COMPOSITION OF ALUMINUM ALLOYS

Alloy	Alloying elements, per cent*				
	Cu	Si	Mn	Mg	Cr
2S					
3S			1.2		
52S				2.5	0.25
17S	4.0		0.5	0.5	
24S	4.4		0.5	1.5	
53S		0.7		1.3	0.25
61S	0.25	0.55		0.95	0.25

* Aluminum and normal impurities constitute remainder.

The second article in this series on the cold working of sheet aluminum will appear in an early issue.

Tips for the cutter grinder

BY A. H. PREY, THE CARBORUNDUM COMPANY

It costs less to keep cutters and reamers sharp than to let them become excessively dull before resharpening. Dull cutters lead to high shop costs

DULL CUTTERS break easily. With proper care they will give long service. Even if a dull cutter can be reconditioned, an excessive amount of material must be removed at each grinding. Only a slight amount of material need be removed if the cutter is reground frequently.

Some milling cutters and reamers are sharpened on the periphery by grinding the clearance angle behind the cutting edge. They include such tools as straight and helical tooth milling cutters, side milling cutters, face mills and end mills. Formed cutters and hobs are ground in an entirely different manner—on the radius.

Clearance angles may be ground with either straight or cup wheels. Two methods are possible with either type of wheel. With one, the wheel passes from the body of the tooth and off the cutting edge. This method has the advantage that the action of the wheel holds the tooth firmly against the rest under the tooth being ground, and so prevents the cutter from rotating. It has the disadvantage of raising a burr on the cutting edge which later must be removed by stoning. This method also may draw the temper of the tool.

If the grinding is done toward the body of the cutter, there is less danger of burning the tooth and no burr is formed. However, the tooth rest must be placed above the tooth, and the action of the grinding wheel tends to move the tooth away from the rest. Unless the tooth is held firmly against the rest by the operator, there is danger of jamming the tooth against the wheel.

Maintenance of the correct clearance angle is of utmost importance. Too much clearance makes the cutting edge too thin, and the teeth will wear rapidly. If the clearance angle is insufficient the teeth will drag and

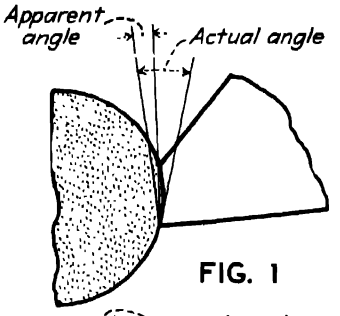


FIG. 1

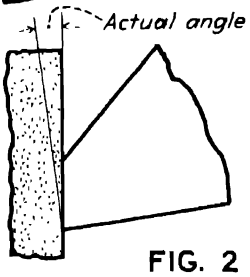


FIG. 2

Fig. 1—When grinding clearance angles with a plain wheel, apparent angle is less than the actual clearance angle at the cutting edge. Fig. 2—This discrepancy does not occur when using a cup wheel

cut too slowly, and the cutter will become dull quickly.

Since a plain grinding wheel grinds hollow, the actual clearance angle is somewhat larger than the apparent angle, as shown in Fig. 1. With a cup wheel, Fig. 2, this discrepancy does not occur. By tilting a plain grinding wheel the surface will not be so "hollow", and the cut will approach a straight line. By this method cutters with narrow lands, and those up to 4 in. in diameter, may be ground satisfactorily with a straight wheel. Large cutters should be ground only with cup wheels. Care should be used when sharpening cutters with cup wheels, since the greater area of contact between the wheel and the tooth tends to heat the work unduly.

The desired clearance angle is secured by adjusting the relative positions of the wheel, the cutter and the tooth rest. If the machine is equipped with dials on the workhead which are graduated in degrees, the setting of the cutter to secure the correct clearance angle is simple. Other machines simplify the setting by using a system of gears in the workhead which produce the correct angle and automatically index each tooth as the grinding is done.

Lacking these devices, the setting of the tooth rest may be determined by tables or by a simple calculation. When using a plain wheel, the distance to raise or lower the cutter and tooth rest is given by the formula: clearance angle in degrees $\times$ wheel diameter in inches $\times$ 0.0088. With a cup wheel, the distance equals the clearance angle in degrees $\times$ cutter diameter in inches $\times$ 0.0088.

When using a cup wheel, with the tooth rest mounted on the wheelhead, the wheelhead is raised or lowered with no adjustment of the tooth rest. If the tooth rest is mounted on the table, the wheelhead is raised or lowered to avoid grinding on the tooth next to the one being sharpened and the tooth rest raised or lowered.

With a plain wheel, whether the tooth rest is mounted on the wheelhead or the table, the wheelhead is raised or lowered, and the tooth rest brought in line with the center of the cutter. Of course, the same effect is achieved by raising or lowering the table in the opposite direction to that indicated above for the wheelhead.

Whether the tooth rest is fastened to the table or wheelhead is governed by the following considerations: it is fastened to the table when grinding tapered cutters and reamers with straight teeth in order to produce the same clearance angle for the full length of the tooth. In sharpening spiral milling cutters on centers, the rest must be fastened to the wheelhead, unless the cutter is free to revolve and move lengthwise on the arbor. In this case the tooth rest may be mounted on the table.

If mounted on the wheelhead, the rest must be set so that the cutter will pass off the wheel before it passes off the tooth rest. In grinding helical mills, the tooth rest must be set to follow the angle of the helix.

With the set-up correct for the

desired clearance angle, the cutter is brought barely into contact with the wheel and passed back and forth. The tooth then is inspected to make certain that the machine is set to follow the old clearance. To make sure that the teeth will not be ground on a taper, grind two adjacent teeth, rotate the cutter 180 deg., grind the two opposite teeth, and measure the diameter of the cutter on the newly ground teeth.

To make sure that the temper of the cutter will not be drawn, be careful not to use too hard a wheel or too high a wheel speed. With a straight wheel, take not more than 0.002 in. cuts—and even less when using a cup wheel. Obviously, if some teeth are higher than others, the high ones will do all the cutting. Therefore, care must be taken to take exactly the same amount from each tooth. Wheel wear may make the last tooth too high. To offset this effect, each tooth should be ground twice, starting at 180 deg. from the first tooth ground when going around the second time.

The hole in the cutter must be round and the mandrel or arbor straight and round. The tooth rest should have a flat top, with rounded corners, and it should be somewhat wider than the wheel so that the cutter can move past the wheel when the next tooth is being indexed.

Continued grinding of the clear ance angle will, in time, make the land too wide. To correct this, sharpen by grinding in the usual way to the desired clearance angle, and then grind a secondary clearance to bring the land to the correct width.

A helical milling cutter should be mounted on a cutter bar which is supported by the footstock. Traverse may be obtained by moving the table or by sliding the cutter on the bar. With table traverse, the tooth rest should be mounted on the wheel head. If the cutter is moved the rest may be on the table, but it is essential that it be in line with the wheel face. Stops should be provided to prevent the cutter from running off the rest. A plain wheel, or a straight or flaring cup wheel may be used.

Care must be taken when sharpening a side milling cutter to keep the land and the clearance angle, as well as the secondary clearance angle to the maker's specifications. The cutter is held on a stud mounted in the workhead spindle, which is swivelled for clearance Either straight-cup or flaring-cup wheels may be used. If a plain wheel is used, the cutter arbor should be horizontal and the wheelhead raised or lowered to secure the clearance.

End mills with shanks should not be located on centers, for if the mill is sprung it will be sharpened out of proper relation to the shank. The shank should be held in the taper of the workhead spindle, which will duplicate the working position of the cutter. The tooth rest should be fastened to the table and the workhead swivelled to secure tooth clearance.

Large face mills should be mounted in a specially designed grinding attachment. On these mills it is necessary to grind the face, the periphery and the corners of the teeth. The corners may be rounded with a radial grinding fixture or, if a true radius is not required, a 45 deg. flat may be ground with a 22½ deg. angle at each side of the flat.

To grind the corners of a shell end mill, the cutter is mounted on an arbor supported by the workhead, which is swivelled to 45 deg. It is best to mount the tooth rest on the workhead, since the work holder then can be adjusted without disturbing the rest Be careful to keep the face of the tooth against the rest.

A helical cutter is mounted on an arbor between centers for grinding. The wheel is rounded to a radius of about $\frac{1}{16}$ in. and tapered back to the thickness of the wheel. The tooth rest is given a slight radius and set so that only its center will be in contact with the cutter at a point on the vertical centerline of the wheel. The cutter, wheel and rest should be in contact at a common point. Allowance must be made in the tooth rest setting for the helix angle in order to get the correct clearance angle. As the helix angle increases, the clearance angle is reduced. If desired, the wheel face may be left square and



The desired clearance angle is secured by adjusting the relative position of the wheel, the cutter and the tooth rest. Cuts with a cup wheel should be light to prevent overheating the cutting edge



When a plain wheel is used, the wheelhead is raised or lowered to secure the proper clearance

the wheelhead tilted slightly. A plain wheel is used.

To grind the side teeth of an angular cutter, the cutter is held on the end of the work spindle which is swivelled to the angle of the cutter. The tooth rest is mounted on the workhead and the table is traversed. Either straight-cup or flaring-cup wheels are used. The same method of mounting is used for grinding the end teeth. To grind the teeth a trifle low at the center, the workhead is swivelled 1 or 2 deg. The tooth rest is fastened to the table, and the work traversed across the wheel.

Reamers must be sharpened more accurately than milling cutters. The land must be narrow and of the same width at all points. Two operations are required. The proper clearance angle first is ground as for a milling cutter. The heel of the blade then is ground off to bring the land to the correct width.

A hand reamer for steel must have a land of only 0.006 to 0.008 in. width. The clearance, therefore, may be ground cylindrically. The wheel must strike the heel of the blade first, otherwise there would be no clearance. When the blade strikes the wheel the reamer springs slightly, which gives all the clearance needed. Secondary clearance then is ground in the usual way.

It is necessary to grind separately each tooth of a hand reamer for cast iron or bronze, since the clearance is too great to be ground cylindrically. The procedure is the same as for a milling cutter. A secondary clearance to give a land of from 0.020 to 0.025 in. then is ground.

In sharpening a roughing chucking reamer for steel the secondary clearance is ground first and the cutting clearance then is ground cylindrically. Next, the blade relief is ground about 0.020 in. smaller than the hole diameter. About $\frac{1}{2}$ in. is allowed for the length of the cutting blade. Last, the corners are ground, using the same wheelhead setting as for the secondary clearance.

Cutting clearance of a finishing chucking reamer for steel is ground cylindrically. The clearance is produced by the spring of the reamer caused by the wheel coming in contact with the heel of the blade before it strikes the cutting edge. A secondary clearance to provide a land of about 0.006 to 0.008 in. then is ground.

Considerable care must be used in sharpening a taper reamer. The land should not be more than $\frac{1}{32}$ in. After sharpening, gage the reamer with a collet. If it seems correct, take a trial cut and test the hole with a gage before using the reamer. The cutting edges must be straight. If honing is not sufficient to straighten them, grind them with a plain or cup wheel.

Some formed cutters are so made that the form of the tooth is on the radius of the cutter. It is important that all sharpening be done by grinding on the face, being careful to keep to the radius. If the face of the tooth is ground at an angle to the radius the shape of the tooth will be changed.

Other formed cutters are off-set; that is, the face of the tooth is at an angle to the radius. This angle must be preserved, or the shape of the tooth will be changed.

Formed cutters are ground either on a cutter grinder or on a surface grinder equipped with proper fixtures. The tooth rest is in contact with the back of the tooth which is being ground. The wheel face must be trued carefully with a diamond. A dish type wheel is used. Feeds should be light. The wheel must be located carefully with respect to the work. Wheel face must be in line with the center of the cutter, except for offset cutters.

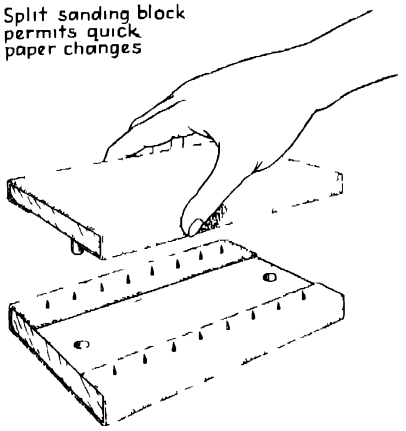
A narrow formed cutter can be fastened to the tool holder mounted on the table and fed by hand. Use a dish type wheel. This method requires skill on the part of the operator, but is rapid. For greater accuracy, use a gear cutter grinding attachment.

A wide formed cutter is mounted on a gang arbor and traversed by moving the table. To insure correct spacing of the teeth, grind the backs of the teeth of a new cutter before grinding the face. The cutter may be rotated very slightly, and the face kept radial, by tapping lightly on the tooth rest holder. Use a dish type wheel. Straight tooth hobs are ground the same as formed cutters.

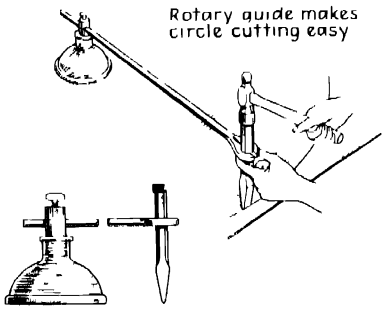
Helical tooth hobs may be ground by various means, using special attachments. A common method is to use a master form which is milled with the same helix as the hob. The tooth rest revolves the hob according to the master form which it engages.

SHORT CUTS FOR THE SMALL SHOP

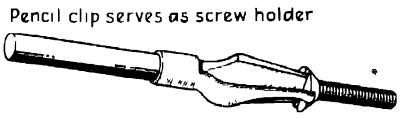
By A. H. WAYCHOFF



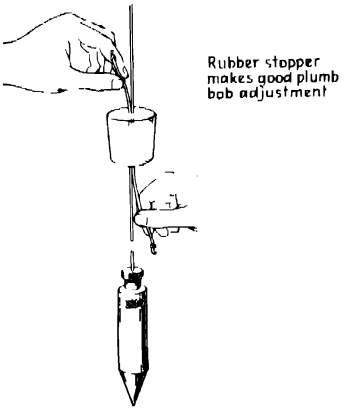
THIS SANDPAPER BLOCK is about tops in simplicity and adaptability. In one piece is set a pair of short dowels, while in the other are drilled holes to match. The dowels should fit a little tight. A few brads driven through each block along the sides, so the points come through about a quarter of an inch, hold the paper. You can use coarse on one piece and fine on the other. The brads bedding into the opposite blocks hold the paper perfectly, and the tight dowels keep the whole works together.



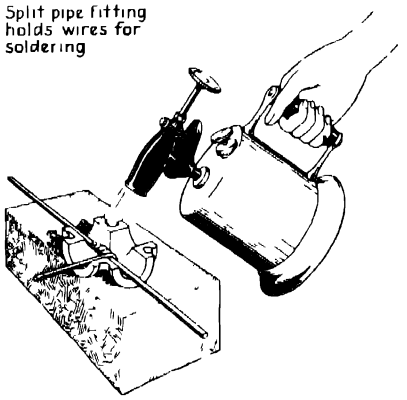
PERFECT CIRCLES can be cut in heavy sheet metal with this handy little device. An ordinary plumber's vacuum cup has an iron plug poked in the handle hole. In this plug is a three-eighths-inch cross hole and a vertical hole drilled and tapped for a wing screw. The rod sliding in the cross hole is split at one end to form a small chisel holder. In use the rubber socket is well soaped so the plug can turn easily, and the rod adjusted for the desired radius. Then by hitting the chisel with a hammer as it's moved around the circle, a perfect disk with smooth edges is cut. For any shop making disks out of metal too heavy to be cut with tin snips, this method is a lot quicker and better than laying out a circle and trying to follow it with a cold chisel.



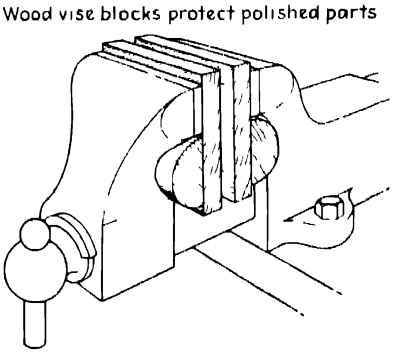
NO TIME IS WASTED making an elaborate screw holder for a screw driver if you use just an ordinary pencil clip. All that has to be done to it is to bend a little kink near the end to catch the screw head. Then push it on the shank and squeeze the body together to make a tight sliding fit. That way it'll hold both screws and small bolts for starting in the most inaccessible places.



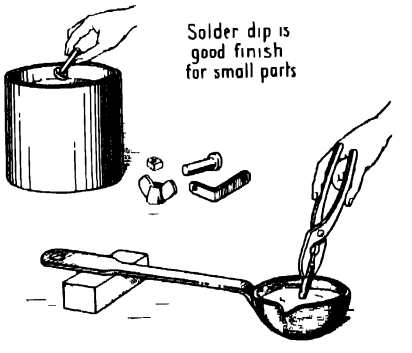
A GOOD WAY to adjust a plumb bob line is to use an ordinary rubber stopper as shown. Punch a couple of holes through it with an ice pick, then run the strings through the holes and knot each end. Adjustment is easy and accurate.



WIRE CONNECTIONS and rod and tube work where right-angle takeoffs are to be soldered can be handled a lot easier with this jig made from a pipe fitting. For average wire or rod work a one-eighth inch fitting is about right. All that is necessary is to split a common "cross" with a hacksaw and use as shown.



WHERE WOOD OBJECTS or polished metal sheets must be held in a vise, these easily made wooden blocks will be found a real convenience. Cut a couple of hardwood blocks a little wider than the vise jaws and long enough to project a little above the jaws when their ends rest on the vise screw or box. Then make a cleat for each block to fit the vise throat, to give parallel seating. The blocks can be held in place with strips cut from an old inner tube stretched around the jaws, if it's desired to use them most of the time.



BRIGHT FINISHING little parts for models or small mechanisms can be done easily just by tinning them. Clean the parts in hot lye water, rinse, and dry. Then dip them in as strong a solution of sal ammoniac as water will make. Let the parts stand till thoroughly dry. Melt up some pure tin, a few old collapsible tubes or some ordinary solder, and with the metal real hot dip the sal-ammoniac-covered parts in it. They can be dipped for about half their length, then turned end for end and the other half dipped. The lap won't show. This coating is bright, adheres perfectly, and is a lot less trouble to apply than rigging up for nickel plating. The parts will stay shiny for a long time, and a coat of clear lacquer will make the finish last for years.

Heavy sections welded well

BY E. JAMES, WELDING ENGINEER, PACKARD MOTOR CAR COMPANY

Good butt and projection welds on steel stampings to forgings depend on accurate control of welding current and time, plus adequate clamping

TYPICAL of the progress made in application of resistance welding to assembly of heavy sections are two operations on the 1941 Packard front-wheel torque arm. In the first operation a forged screw plate is flash-butt welded to one end of the 0.157-in. thick torque arm. In the second a steel bushing with a $\frac{9}{32}$-in. thick wall is projection welded concentric with the hole in the opposite end of the stamping. A production research program under the guidance of J. E. Doyle, general master mechanic, made practicable these operations.

Uniform Thickness Essential

The torque arm assembly measures 24.570 in. from the finished face of the screw plate to the center line of the bushing hole. The latter must be reamed $1\frac{3}{8}$ in. $\pm$ 0.005 in., and the wall thickness must be uniform. Consequently, in the first operation, the piece is located from the bushing hole. The forging end face must not exceed $\frac{1}{32}$ in. over final dimension, to permit cleaning up by grinding. When projection welding the bushing, the torque arm is located from the forging end face. If the axis of the bushing is tipped one minute of arc, the wall thickness after reaming may vary as much as $\frac{1}{32}$ in. on one side, because of error magnification by length and angular relationships of the components. These considerations call for accurately controlled welding cycles, heavy fixtures and well-guided machine slides. To meet these requirements, special press welders of heavy arc-welded construction have been built to Packard specifications.

Flash-butt welding the screw plate to the torque arm is done at the rate of 300 assemblies per hour. The stamping is placed flange side up in the stationary part of the fixture. Two pushbuttons, pressed by the operator, energize a holding circuit in the weld timer, to start the welding cycle.

Several actions now occur automatically. The holding circuit energizes a solenoid valve controlling two 5-in. direct-acting cylinders operating vertical clamping slides. These slides move down into contact with the stamping and the forging respectively, until a force of 16,000 lb. is applied to the two parts. When this is reached a pressure switch is tripped, energizing a second solenoid valve. This valve brings into play four 3-in. cylinders which apply side clamping pressure. Two opposed cylinders are used on the stationary half of the fixture, two more on the movable section. When correct pressure is built up in these cylinders, another switch is stripped, which in turn operates a limit switch to start the table in motion. In addition, a relay is tripped to energize the welding contactor and the Ignitron heat control panel.

Burn-off and upset are obtained by a cam-operated table which moves the forging into contact with the stamping. Total movement is $\frac{9}{10}$ in., a burn-off of $\frac{9}{32}$ in. being allowed on each piece. An upsetting pressure of 9,000 lb. is reached on this particular job. A variable-speed drive to the table cam permits changing burn-off time. At the end of the upset, the table and all clamping cylinders automatically return to loading position.

Electrical Demands Heavy

The hydraulic system includes a combination pump which delivers oil at 300 lb. pressure to the small horizontal clamping cylinders and at 600 lb. to the larger vertical cylinders. This pump is capable of delivering 13.7 gal. per min. and is driven by a 5-hp. 440-volt three-phase motor.

The machine draws 1020 primary amperes, delivered on a bus consisting of four pieces of $\frac{1}{4}$x6 in. copper. This bus is also used for the projection welder. Electrical controls consist of a welding contactor, an Ignitron-tube heat control panel and a 225-amp. two-pole circuit breaker. A 250-kva. water-cooled transformer with an eight-step secondary for heat control is located within the welder base.

Successful projection welding of the bushing to the torque arm required solution of a number of problems before the desired metallurgical properties were secured in the bond. Not the least of these problems was the projection shape. First tried was the common rule-of-thumb: a projection height equal to two-thirds of the metal thickness, equal included angles of the sides, and a flat, or land, about $\frac{1}{16}$ in. wide. This projection produced a bond that did not fail in a destruction test, but a microphotograph revealed a definite separation between the crystalline structures of the two parts.

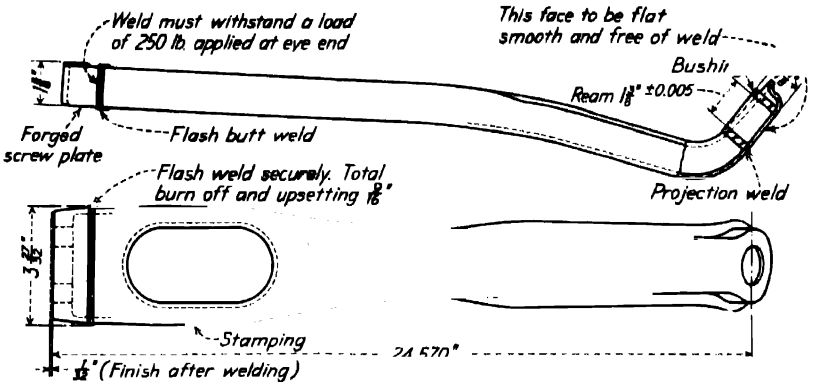
Shape Found by Experiment

Next, experiments with projection shape were instituted. Each time new values for current, time and pressure had to be established. Even the bushing material was changed. A microphotograph was made of each test weld. Use of microphotographs in production research on welding problems materially shortens the cut-and-try process and gives direction to the work.

Finally, a proper bond was secured by the projection shape illustrated. Unequal angles of the projection cause the metal to flow into a smooth-radiused joint with the stamping, and without flash at the plane marked. It will be seen from the microphotograph that the crystalline structures of the two metals are well intermingled, or "married." This is a "perfect" weld, as far as it is possible to make. There is no question of weld failure in service.

A problem in welding-fixture design presented itself because of the shape of the torque arm and the necessity for keeping the bushing exactly at right angles with the angular face of the stamping while upsetting the weld. For this reason, the bushing is placed over a hard bronze plug in the stationary electrode on the press welder knee. The torque arm is clamped in a fixture which is connected to and moved down with the slide. In placing the torque arm in

Resistance welding makes possible a torque-arm assembly like this. Savings are worth the effort expended on an extensive production research program

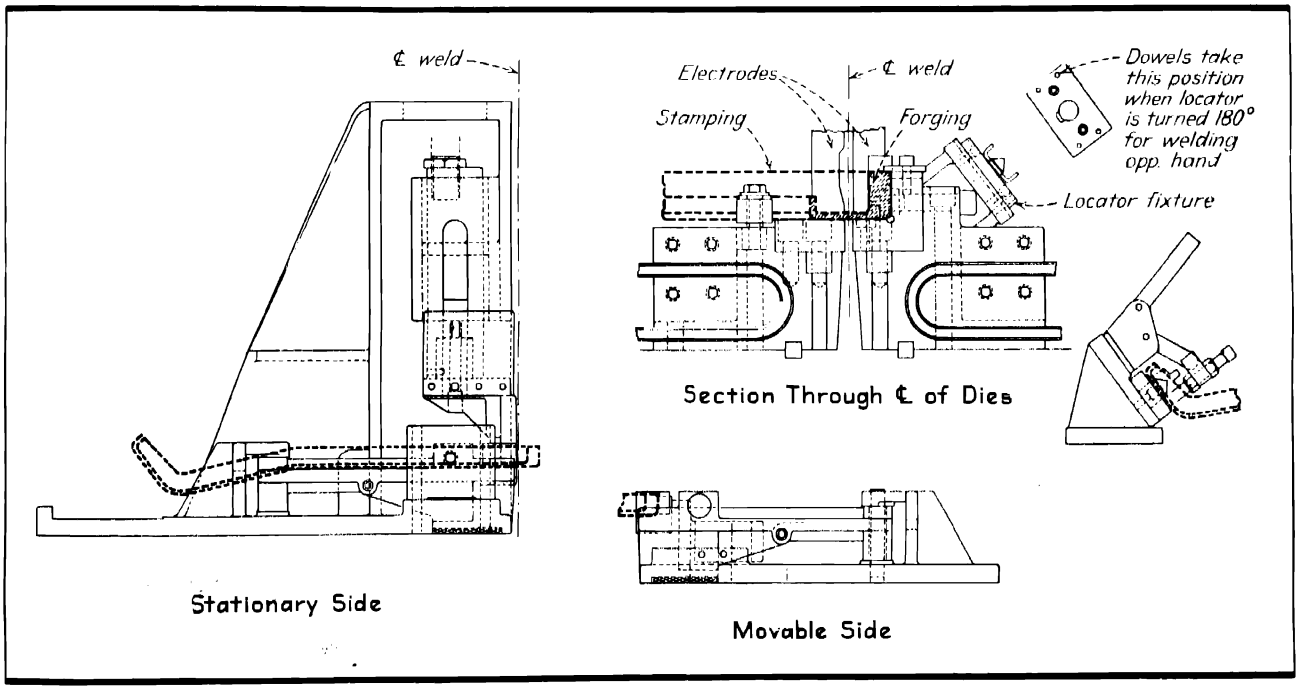


the fixture, the circular end is located in a nest fixed to the ram, while the center and the opposite end are located and held by two hand-operated cam clamps. Rectangular guide bars connecting the fixture to the slide are made of brass to avoid a disturbing magnetic field near the electrodes. A limit switch on the slide prevents welding if a bushing has not been inserted properly in the stationary fixture.

The projection welding process is entirely automatic after the operator presses a button. This action energizes a holding circuit in the special weld timer. The holding circuit in turn energizes a solenoid-controlled valve which admits oil at low pressure to the cylinder to feed down the V-guided clamping slide. When a predetermined pressure is built up in the cylinder a pressure switch is tripped, which starts a special weld



Flash-butt welding the screw-plate forging to the torque-arm stamping involves moving and stationary fixtures. Vertical and hydraulic cylinders conveniently apply clamping pressures to both fixtures. Upsetting slide is cam-driven



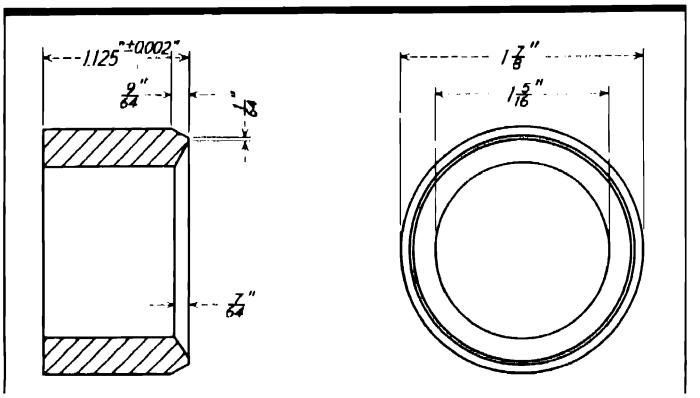
Heavy, accurately built fixtures align the forging and torque arm stamping for flash-butt welding. Upsetting is controlled to attain minimum flash



timer controlling an electronic-tube contactor. Current is applied to the weld for six cycles, at which point the low-pressure circuit in the timer drops out. The high-pressure solenoid valve is immediately tripped to build up an upsetting pressure of 28,000 lb. There is actually no interruption in welding current between low- and high-pressure welding. Current is instantaneously resumed when the high-pressure circuit is energized and it is continued for eight more cycles. When upsetting is completed, a relay is tripped, releasing the high clamping pressure, returning the machine to the loading position and resetting all of the controls for the next cycle.

The projection welder incorporates features to permit its use on other jobs by merely changing fixtures and resetting controls. Shut height adjustment amounts to 3 in., and knee adjustment of 8 in. is secured through two leadscrews. A wide range of heat control is provided by the Class A (Resistance Welder Manufacturers Association standard) transformer,

Before oil smoke can clear away, the operator swings aside the welding curtain and removes a completely welded torque arm from the special press - type projection welder developed at Packard



Correct shape of the bushing projection was obtained by experiment

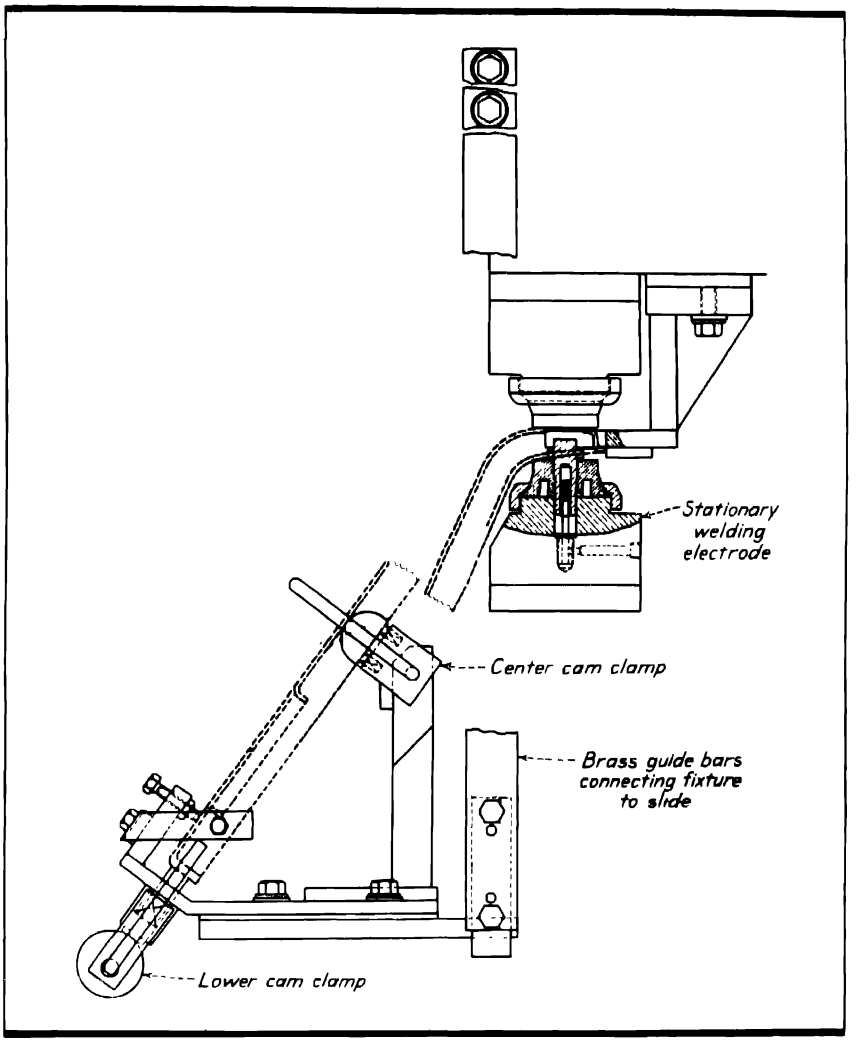
Cut-away sections of the bushing and stamping show that correct projection shape promotes a smoothly radiused upset without flash at the bushing hole. A photomicrograph at section A-A reveals metallurgical properties of the weld. Magnification is 200 times. Bushing metal is above, stamping structure is shown below





mounted in the machine base. This transformer has sixteen steps of heat regulation, is rated at 700 kva. 60 cycles, and operates on 440 primary volts. Electrical controls consist of an electronic welding contactor, a special timer, and a 600-amp. circuit breaker. The machine draws 4,800 primary amp., delivered on four pieces of ¼x6 in. copper bar from a bank of two 500-kva. power transformers which are installed outside the building.

The hydraulic system includes a combination pump driven by a 5-hp. 440-volt motor. The pump delivers 13 gal. per min. for low-pressure clamping of the head, and 1.6 gal. per min. for the higher upsetting pressure. Maximum pressure attained by the pump is 1,000 lb. per sq. in. An unloading valve and a pressure-regulating valve unit are included in the hydraulic equipment. Stable oil temperature is attained by equipping the machine with a 30-gal. sump complete with water cooling tubes.



To compensate for upsetting the bushing projection, the fixture containing the torque arm must move down with the welding-machine slide by the amount of upsetting

Metal That Burns

PRECAUTIONARY MEASURES against magnesium fires are hard to enforce because the mind rebels at the idea of a metal burning, and these fires are difficult to extinguish because the most natural thing to throw on a fire—water—is virtually the worst imaginable for magnesium.

The fact remains that magnesium alloys do burn very intensely in powder, ribbon, chip or dust form. Heavier pieces are not particularly combustible as they rapidly conduct away the heat; however, when an entire piece can be brought up to about 1,000 F., ignition will take place.

Oxygen for combustion of magnesium is supplied more rapidly by water than by air. Thus wet magnesium burns more intensely than does the dry metal, and once ignited it will continue to burn under water. For this reason, all common water-type extinguishers are worthless on magnesium fires. Carbon tetrachloride on hot magnesium gives off chlorine. Carbon dioxide, foam and dry chemical extinguishing agents give off oxygen. Both chlorine and oxygen combine with the burning metal to intensify the fire.

Where magnesium chips are already covered with cutting oil, combustion is not so rapid, since the air necessary for combustion is cut off by the oil film. Using oils to extinguish fires, however, is not advisable because it is difficult to apply without igniting the oil itself.

Fires in small quantities of scrap are best extinguished by powdered talc, cast-iron borings, or similar inert material. When the magnesium has considerable bulk, there is no practical way of extinguishing the fire. Effective prevention is the only reliable insurance against a serious blaze.

In machining magnesium, no water, even in mulsifiable cutting oils, should be used. If dry machining is not practical, a mixture of kerosene and lard oil or straight kerosene is preferable. Turnings should be constantly swept up, so that if ignition occurs at the cutting tool, as it may from friction, the fire will not spread.

Magnesium dust in air is highly explosive. Because of this, ordinary types of dust collectors should not be used to remove dust from grinding. A special collecting system is needed, which utilizes a water spray to wash the dust into a trough where it will be carried away as sludge. This should be collected in drums, mixed with four or five parts of sand and disposed of on a dump. In this condition it may still burn but with little intensity. In actual grinding of magnesium alloys, only grinding wheels reserved expressly for this purpose should be used. If the wheels are used for ferrous metals also, particles may adhere which might produce disastrous sparks.

From a report of Factory Mutual laboratories fire tests on magnesium alloys, conducted under the direction of the Inspection Department of Associated Factory Mutual Fire Insurance Companies.

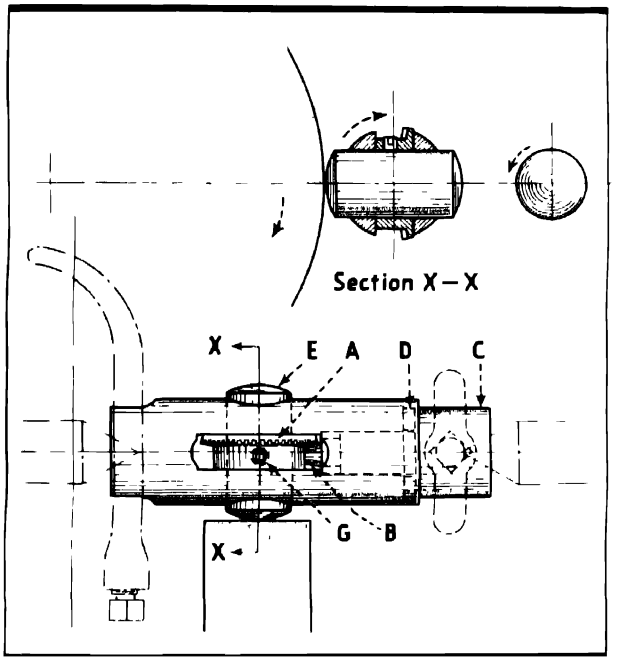
IDEAS FROM PRACTICAL MEN

Fixture for Grinding True Radii on Pins

By PETER VEIT

The illustrated fixture was designed to grind the ends of pins spherical with a true radius, regardless of the length of the pin. The master ring gear *A* is cut with 75 teeth, while the pinion gear *B* has 19 teeth. The pinion gear shaft *C* should be clamped so that it does not revolve; this is extremely important. The pinion shaft *C* is fitted with thrust bearing *D*.

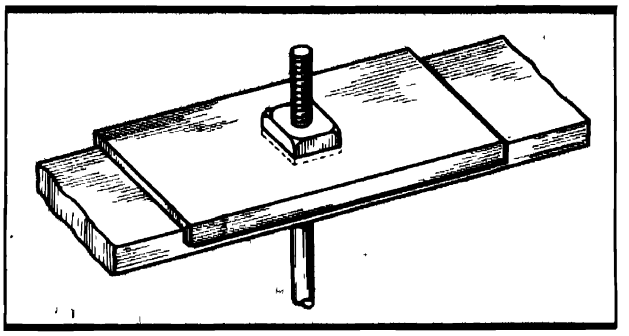
The pin to be ground is inserted in the fixture



This fixture will grind spherical surfaces with true radii on pin ends regardless of its length

through the ring gear *A*, and the set screw *G* in the ring gear is tightened. The pin is centered for length. The fixture is driven by a dog or forked driver on the headstock end. Direction of rotation of the pin, fixture and grinding wheel are shown by arrows in Section X-X. As the fixture rotates on the spindle and headstock center, turning the pin end for end and bringing the ends into contact with the grinding wheel, the pin rotates in the fixture. The combined action of such rotation results in grinding the ends spherical.

The gear ratio used is such that it takes 75 revolutions for the pin to pass the wheel at the same spot. Should an 80:20 ratio be used, the pin would grind from four sides and there would be two radii, but they would not be spherical. The design or shape of the fixture can be changed to suit various requirements, such as for grinding pin gages or floating wrist pins.



This device not only provides means for locking the nut, but also serves as a wrench for turning the nut when adjustment is necessary

Combined Nut Lock and Wrench

By L. KASPER

The accompanying sketch shows how, by a simple expedient, a nut may be locked against turning, the locking attachment itself serving as a wrench when turning is desired. A threaded rod passes through a bar, the nut being used for making adjustments. A channel-shaped piece having a square hole in the center is dropped over the nut, the legs of the channel engaging the edges of the bar, thus locking the nut against rotation. When adjustment is necessary the channel piece is lifted up clear of the nut and is turned over with the legs uppermost, thus providing a wrench with which the nut can be turned.

One-Operation Die Forms Split Tubes

By GEORGE K. SCHRAY

We had a problem to make a tube which had to be held within 0.003 in. on the diameter. Seamless steel tubing was prohibitive because of the cost, and a seam was not objectionable as long as it was closed tightly. The protruding parts of the notched end of the tube shown in the drawing had to be formed and spaced so that they could easily be pushed through punched slots in the back of the instrument in which it was to be used. Furthermore, it was necessary to have a narrow bulge clear around the tube and large openings at the other end to permit quick circulation of air. These specifications are added to show that with all these punched holes and formed ribs in the blank, the die described here worked without a miss of any kind.

The blank should be parallel to insure a uniform diameter of the tube. We used a cut-off blanking die, which also trimmed the blank to the exact width. The die consists of the bottom *A* and the top *B*. The

mandrel *C* is carried by two bearing blocks *G* which are each fastened to the ends of part *A*. Pressed into part *A* are a series of pins *D* for which clearance holes are provided in *B*. These pins should be placed close to the edge of the half-round contour of *A*. The number, diameter and position of these guide pins are determined by the shape of the blank.

In operation the blank *I* is inserted between the mandrel *C* and die *A*. When the top part *B* of the die descends the blank slides along the contour of *B* until it strikes pins *F*. These pins, which were spaced about 1 in. apart for 16-gage steel stock, are filed off on one side parallel to the axis to have a broader surface of contact. These pins push the blank between mandrel *C* and die *A*. Were it not for pins *D* the blank would buckle enough to protrude far over the point *X*, which would no doubt have a disastrous effect when the die closes. To insure no shifting of the blank which would bring the top edge of same on the outside of point *X*, we provided the two outside pins *D* with special spring *E*.

Because the mandrel is mounted loosely in *G* it will turn as the blank moves around in the space between *C* and *A*. The blank will more or less follow *C* and in closing strike the bevelled end of the pins *F*, thereby forcing them into *B*. Because a solid squeeze will close the tube tightly it is advisable to make the halves in *A* and *B* shallower than half the outside diameter of the tube. We also found that the slight rounding of *X* and *Y* and opposite edges in *A* prevents any scoring of the blank.

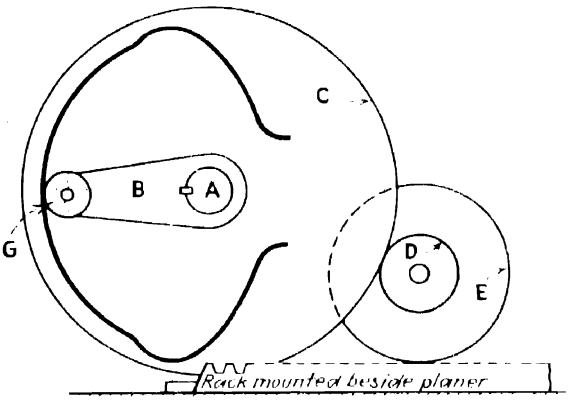
Care should be taken to mount the mandrel freely so that the finished part can be removed easily; this was done as shown in the perspective sketch. The mandrel is turned down on each end to serve as bearings and handles. The shoulders fit between the bearing blocks *G* and prevent end play. The sides of the hardened blocks *G* serve as guides for the blank and should not be spaced much farther apart than the length of the blank. The bearing blocks were slotted as shown and the mandrel was held by pins *H*.

After the tube was formed those two pins *H* are partly withdrawn, the mandrel taken out and the finished part removed. By making the diameter of the mandrel a few thousands undersize we found that it greatly helped the stripping of the tube and also took care of the variation in the thickness of stock.

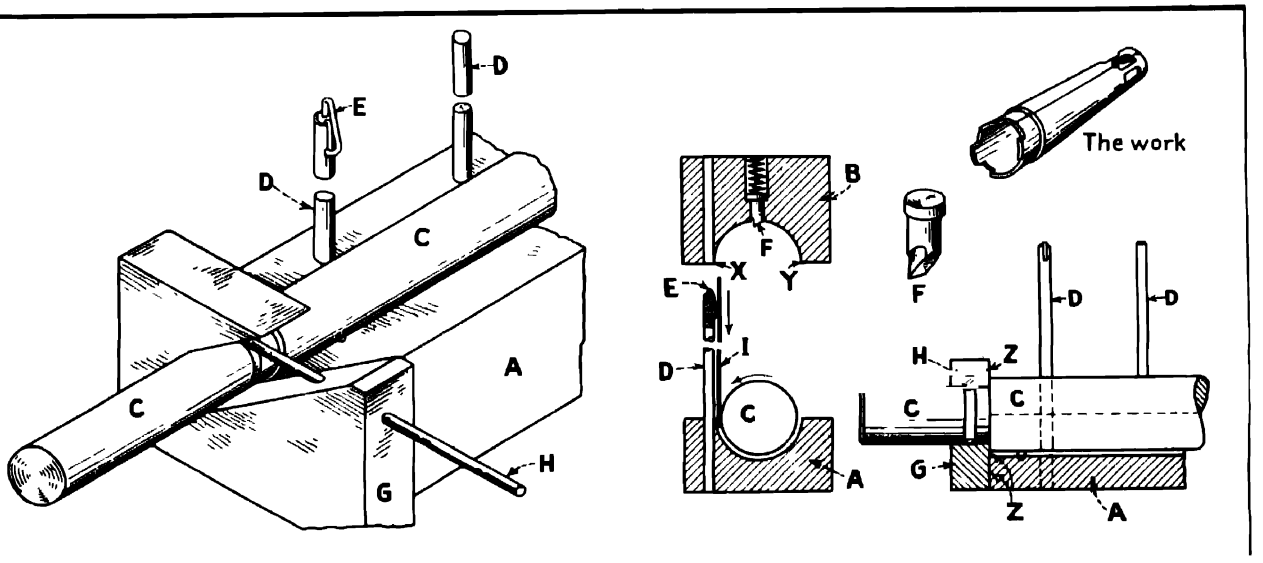
Grinding an Inside Segment

By FRANK C. HUDSON

Several large castings for a special job had an inside segment of a circle that had to be ground to true and to a good finish. The inner surface of the casting is shown by the heavy white line in the drawing.



This train of three gears, operated by a rack on the planer table, oscillates a grinding wheel for finishing a radius on the inside of large castings



A split tube can be formed in this die in one operation by inserting a parallel blank between the mandrel and the die shoe. As the die descends, the blank slides along the contour of the die and is held to within 0.003 in. variation on the diameter by the mandrel

ing. The outside is not important except that it had a flat side which could be bolted to the planer table. The problem was to oscillate the grinding wheel *G* through the proper arc and feed it across the face of the work.

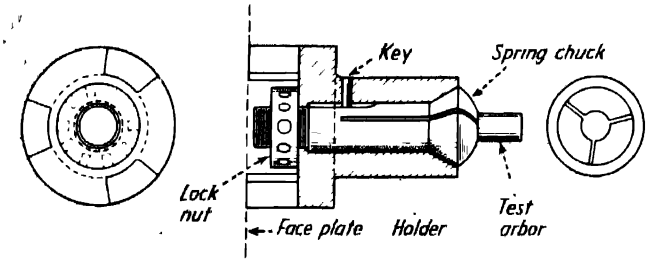
The splined shaft *A* was large enough to prevent springing and was mounted in substantial supports at each side of the work castings. It carried the arm *B* which supported the small, motor-driven grinding head *G*. The spline and key permitted the arm to be fed across the work by a star feed.

Oscillation of the grinding wheel was secured by a rack, supported beside the planer table, meshing with the gear *E* of the three-gear train. With the grinding head driven by its own motor, through a flexible power line, the planer table moves the work back and forth at slow speed. The rack beside the planer drives gear *E*, while *D*, mounted on the same shaft, drives the gear *C* and swings the arm *B* with the grinding wheel through the necessary arc. By setting the planer table dogs at the right points the arc of travel can be regulated very closely.

Holder Makes Spring Collets Run Through

By GEORGE J. MURDOCK

Due to wear and hard usage, spring-collet chucks will often fail to run perfectly true. This is sometimes aggravated by the worn nose of the lathe spindle. Then too their use is generally confined to work concentric with the axis of the spindle, making it impossible to turn or grind work that must be eccentric. To circumvent these defects the illustrated independent collet



This spring-collet holder can be mounted on a face plate or held in a three-jaw chuck. Once set, the collet will always run true

holder was designed for use with the face plate or independent three-jaw chuck.

It is placed in the chuck, or strapped to the face plate, after which a testing rod or plug is placed in the collet. The base shifted if in a chuck, or moved over if on a face plate, until it is shown to run true by an indicator. The test plug is then removed, and the work to be turned or ground substituted with the certainty that it will run true even if removed from the chuck and replaced for final machining operations, or turned end for end.

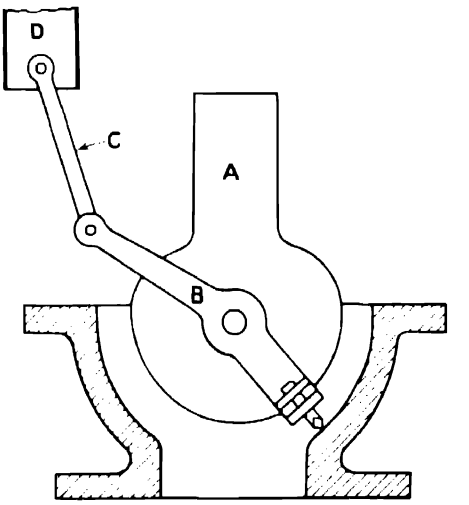
This holder is also useful for holding spring collets on the dividing head of the milling machine, or on surface grinder for it is self-contained. It requires no draw-in spindle, the chuck being tightened on the work, or released by the use of a pin inserted in the rim of the locknut in holes provided for that purpose, as shown in the drawing.

Preferably it is made of tool steel hardened, and ground at all important bearing surfaces, but it may be made of cast iron, or of machine steel, pack hardened.

Pivoted Fixture Bores a Ball-Socket Joint

By FRED H. COLVIN

Having an order for some large ball sockets for pipe joints we picked a boring mill with two rams to do the job. The tooling method was simple, but effective, as shown in the drawing. A heavy plate *A* was flame cut to about the shape shown, and hole

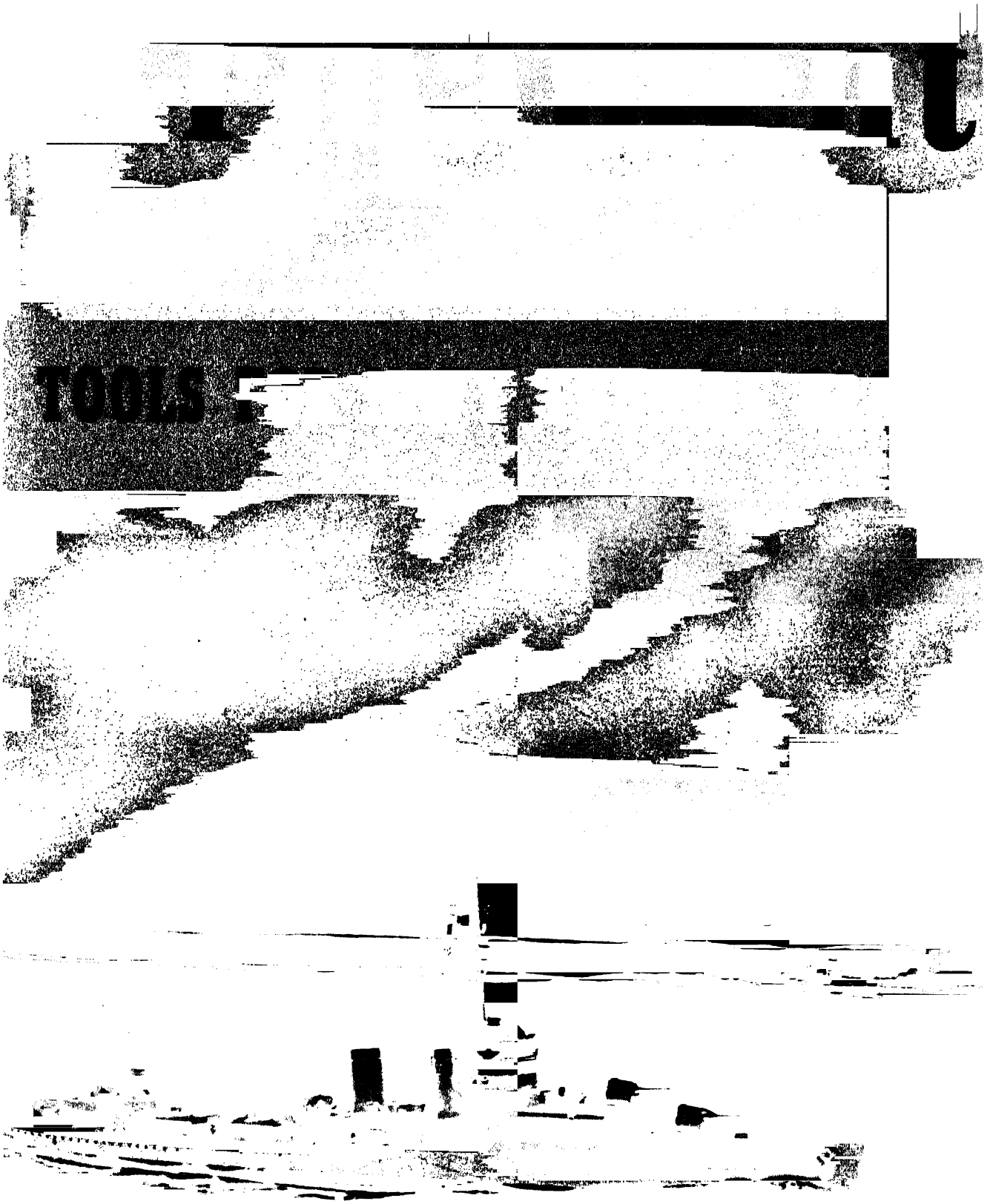


A number of large ball-socket pipe joints were bored by feeding downward the left-hand ram of the boring mill to which was attached this pivoted tool holder. The pivot member was mounted on the right-hand ram

drilled to pivot the tool-carrying bar *B*. The arms, *B* and *C* were flame cut and drilled for the connecting pins. The driving arm of *B* was not 180 deg. from the tool end but was put at an angle to equalize the arc of arm movement around the pivot pin in *B*. Plate *A* was bolted to the tool block of the right-hand ram of the boring mill. Arm *B* was attached to the left-hand ram by link *C*.

The right-hand ram, carrying the tool plate *A*, was set so as to bring the center of the pivot pin in line with the upper flange of the work. Tool movement around the pivot pin was secured by feeding the left-hand ram down. Cutting tool adjustment was made by tapping the tool on the back end with a hammer. This rig proved very satisfactory on this work.

TOOLS



TOOLS FOR NAVY TURBINE BLADES

Shops equipped only with standard machine tools can machine turbine blades by using the special fixtures developed by the New York Navy Yard and described in this article

THE NAVAL EXPANSION PROGRAM is in full swing. The ultimate goal is 800 warships and auxiliary vessels for a two-ocean navy. Turbines for these ships are produced by private manufacturers and navy yard shops, but subcontractors are supplying many parts in semi-finished or finished form. Among the latter, and probably one of the most important items, is turbine blading, machined to exacting tolerances and specifications.

The blades are made from corrosion-resisting steel stipulated in U. S. Navy Department Specification 46S12d as Class "a" material, heat-treated for machining. Rectangular bars for these blades must be delivered straight, straightening after final heat-treatment being prohibited. They are ordered to exact lengths so they can be cut to the length of blades in various turbine stages without excessive waste.

The steel must be made by either the crucible or electric process, and each lot of bars submitted for inspection must be poured from the same melt and heat-treated in the same furnace charge. Hardness must be 200-240 Brinell or 15-24 Rockwell C. Chemical requirements are as follows: carbon, 0.06-0.13 per cent; manganese, 0.25 0.80; phosphorous maximum, 0.03; sulphur maximum, 0.03; silicon maximum, 0.50; chromium, 11.5-13.0; nickel maximum, 0.50. Tensile strength required is 100,000 lb. per sq.in., while the proof stress, determined by use of an extensometer, must be 70,000 lb. per sq.in. and must not produce a permanent set of more than 0.0002 in. in 2 in. upon removal of the load. Specified elongation in 2 in. and reduction of area are 20 and 60 per cent, respectively.

The New York Navy Yard is manufacturing turbine blades for naval vessels, using fixtures made at the yard for use on standard machine tools. The fixtures and machining operations for producing blades for one high-pressure and one low-pressure stage of one turbine for a naval vessel are herein described. However, fixtures for blades in other stages are similar to those shown here, varying only in dimensions to accommodate different blade sizes.

The rectangular stock for the blades comes to the shop in specified lengths, depending on the number of blades to be cut from each bar. The width and thickness is also specified for each stage, with $\frac{1}{8}$ in. allowed for machining. Each bar is tested in at least three places for hardness before machining starts.

High Pressure Blading

The blades for turbines with eleven high-pressure stages vary in height from $\frac{1}{2}$ to $3\frac{1}{4}$ in. and have straight, rather than helical, concave and convex steam passage surfaces; however, in fourteen-stage turbines the blades in the last few stages may have helical steam-passage surfaces. The bar stock for straight-surface blades is cut into lengths from which two, three or four such blades can be pro-

duced. The top, bottom and sides of each length is ground square with each other to finished dimensions and held to tolerances of +0.000 in. and −0.001 in. One end is then faced square with the ground surfaces, leaving one end unfinished.

This piece is placed in a fixture for milling the convex side of the blade, the squared end of the stock and the ground sides being used to locate it. The fixture is shown in Figs. 1 and 13, the latter illustrating the profiling of low-pressure blades. The profile on high-pressure blades, and the operations in succeeding fixtures are indicated in Fig. 2



Fig 1 —The back of the blades is machined in a fixture having four blade holders and four cams, the contour of the latter is that of the convex profile produced on the blade The fixture is mounted on a sliding table and is held against the cutters by a leverage system actuated by air pressure

The profiling machine and fixture shown in Fig. 1 for machining the convex side of the blade consists essentially of the milling cutter *A*, driven by a motor beneath the table, the roller *B* mounted on the cutter arbor, the blade holders *C* of which there are four, and th cams *D* the shape of which conform to the profile on the back or convex side of the blades. The fixture with blade holders and cam followers are mounted on a table *E* which is movable transversely; table *E* and the blade holder are mounted on a table *F* movable longitudinally. Table *F* is connected by levers to an air cylinder beneath the table. The pressure required to hold the blade against the cutter varies from a minimum to a maximum and back to a minimum as the profile of the convex side, indicated as operation No. 4 in Fig 2, is being machined. The air pressure in the cylinder beneath the table, and therefore the longitudinal forces on the table *F* exerted by the leverage system, is varied by a differential air-pressure valve *G* attached to the fixture and operated from a cam on the

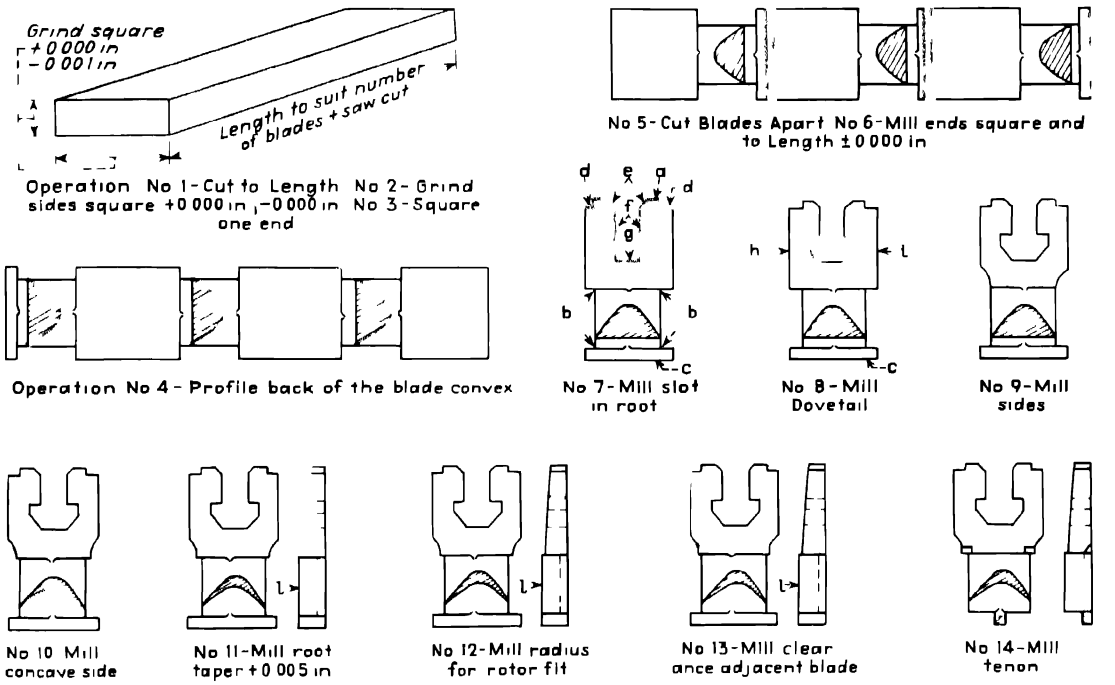


Fig 2 These are the operations used at the New York Navy Yard for machining high pressure turbine blades for a naval vessel The remaining operations are grinding the root taper to finish size ±0.000 in sanding and polishing concave and convex sides of the blade magnaflux test for flaws nitric acid test the material and inspect for size and profile

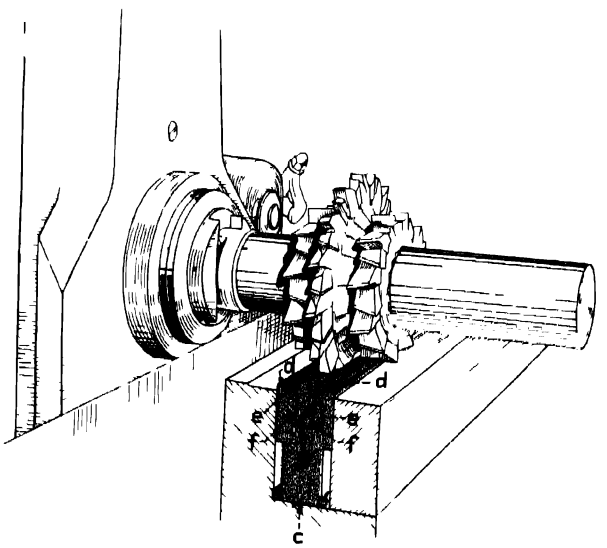


Fig 3 —Slots in the roots of the blades are milled with 10 blades in the fixture In this and all other fixtures, the blades are located accurately from surfaces previously machined to finished dimensions

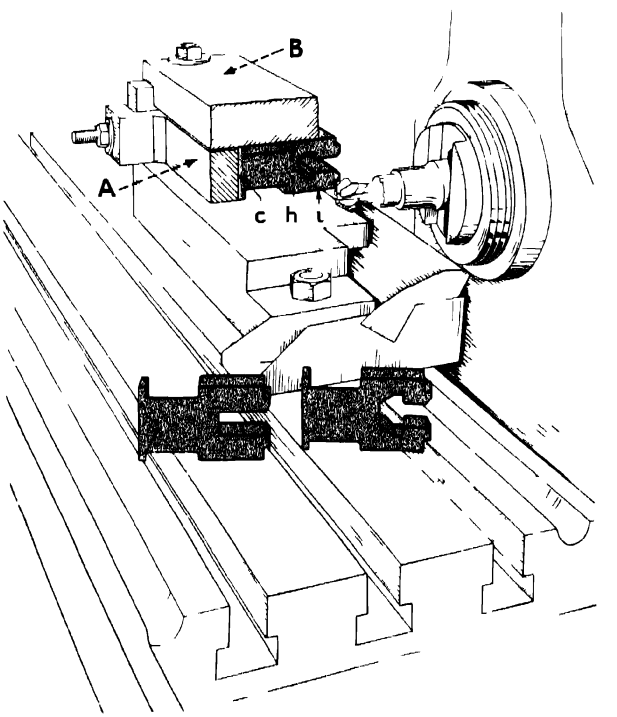


Fig 4—Rotor dovetail fit is milled in the root of each blade after machining a slot for clearance of the cutter shank Operations Nos, 7, 8, 9, 11 and 13, all indicated in Fig 2, are done in clamping fixtures similar to the one shown here

cutter arbor; this valve is shown in the foreground in Fig. 13. In all cases the convex side of the blade is an exact reproduction of the cam, each of which is made the shape of the blade required, ±0.000 in.

Transverse movement of the table *E* is required when profiling helical-shaped blades, in which case the profile adjacent to the root is not parallel with the root and tenon ends as explained in conjunction with Fig. 13. Such movement of the table *E* and therefore the blade holder, is accomplished by a cam on the end *K* of the blade-holder spindle; however, the cam is not shown in Fig. 1. The cam is actuated by pins *H* set in a block bolted to table *F*.

When more than one blade is made from a single piece of rectangular stock, the profiled bar is slit with milling cutters and the ends milled square with the top, bottom and sides as shown in operations Nos. 5 and 6 of Fig. 2.

Sixteen blades are placed in a fixture for milling the slot in the root as shown in Fig. 3. This operation is No. 7, shown in Fig. 2. Prior to this operation face *a* had been milled square with the top, bottom and sides of the blade, the surface *b* has been machined during profiling, using face *a* and the squared sides as locating edges. Face *c* had been milled square with all other surfaces. In operation No. 7, surfaces *d*, *e*, *f* and *g* are milled as shown in Fig. 3 to exact dimensions, using surface *c* and the squared sides of the blade as locating edges. Thus, as machining proceeds in the various fixtures, the blades are located in the fixtures using surfaces previously machined to close tolerances.

In milling the dovetail in the root of the blade, sixteen blades are placed in the fixture shown in Fig. 4. The removable side *A* and top *B* of the fixture clamp the blades on surfaces *c* and *h*, indicated by operation No. 8, Fig. 2, with surface *i* resting on the base of the fixture. The dovetail is milled after the dovetail recess in the front of the fixture is aligned with the milling cutter by proper adjustment of the machine table. Following this operation, the sides of the root adjacent to the profiled section of the blade are milled as indicated by operation No. 9, Fig. 2.

The concave face of each high-pressure blade is milled, in the fixture shown in Fig. 5, using a two-fluted cutter. The blades are located between blocks *A* and *B*, and adjusted for height by block *C*, for which recesses are provided in the movable vise jaw *D*. Single blades are machined to permit chips to fall away from the face of blade and thereby prevent scoring of the machined surface. The depth of the cut is controlled by the adjustable stop *E*, which can be set to precise location by the calibrated nut *F*.

Operation No. 11, Fig. 2, is next performed with sixteen blades in one fixture. The base of the fixture is set at an angle while the face of the milling cutter is in a horizontal plane. The root taper is milled to within 0.005 in. of finished size; the taper on the root is finished

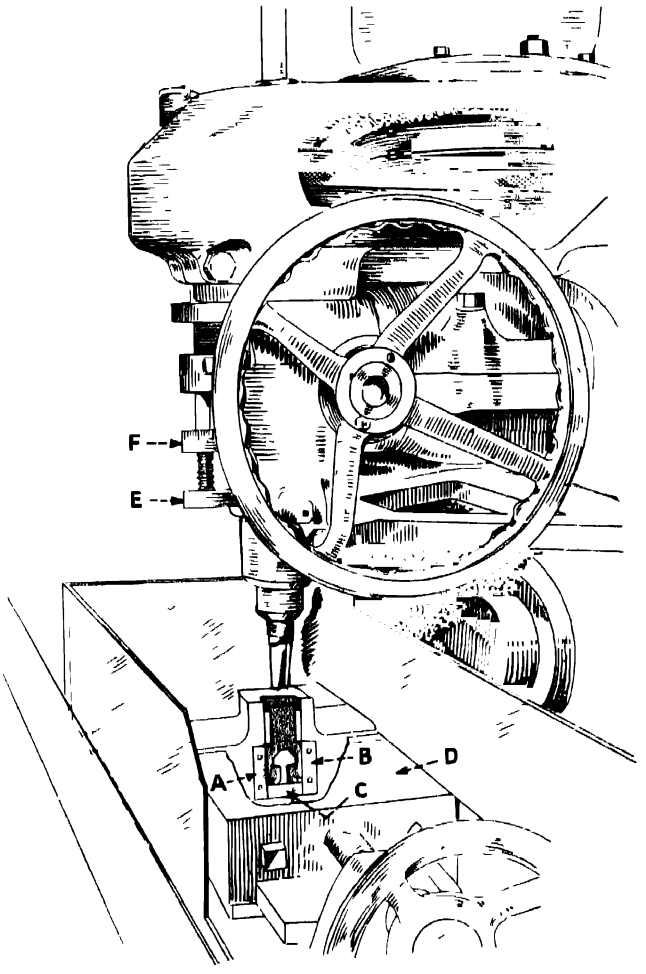


Fig. 5—The concave side of high-pressure blades with straight blade surfaces are milled one blade at a time with a two-fluted cutter. A fixture with two blades face to face was discarded because the chips scored the concave face

by grinding to required thickness, +0.000 in.

One face of the dovetail, operation No. 12, Fig. 2, must be milled to a radius conforming to that of the turbine rotor. The fixture for making this cut is shown in Fig. 6. The blade is located vertically between blocks *A* and *B* and horizontally by screw *C*. The blade root protrudes beyond the blocks *A* and *B* for clamping with swivel blocks *D*; the top swivel block has been removed to show the blade. Bolts *E* extend to the back of the fixture and are fastened to a vertical rectangular bar which bears against a lever operated by an eccentric. This eccentric clamp positions the blade for milling face *k* as illustrated in Fig. 6.

After the root taper has been milled and ground, the edges *l* of the blade shown in Fig. 2 extend beyond the root. When assembled on the rotor, clearance must be cut in the root of the adjacent blade for the protruding edges. Such clearance is shown indicated by operation No. 13, Fig. 2.

Milling of the tenon, operation No. 14, Fig. 2, is done in the fixture shown in Fig. 7. The blade is placed between accurately spaced blocks *A* and *B*, and is located vertically by rod *C* the end of which fits into the finished dovetail in the root. The movable vise jaw *D*, recessed to fit the stationary jaw *F* with the blade and locating block assembly, is operated by air-cylinder *G*. The depth of the cut is controlled by an adjustable stop similar to *E* in Fig. 5.

Following the foregoing milling operation, the root taper is ground to finished dimensions ±0.000 in. The set-up for this operation is shown in Fig. 8. A number of blades from any one stage is placed on a magnetic chuck *A* mounted on a fixture consisting of plane sections *B* and *C* hinged at *D*. The rod *E* is affixed rigidly to section *B* and is fitted with elliptical pieces *F*. The section *C* is bolted to the grinder table. For the blades in each turbine stage, sine blocks *G* are placed between elliptical pieces *F* and section *C*; these sine blocks tilt section *B*, magnetic chuck *A* and the blades to the proper angle for grinding the root taper. The grinding wheel is notched as shown in Fig. 8 to throw off girts, thereby preventing them from adhering to the wheel and scoring the finished tapered surface.

The convex and concave surfaces of all blades are sanded and polished to a bright finish. The entire blade is then subjected to

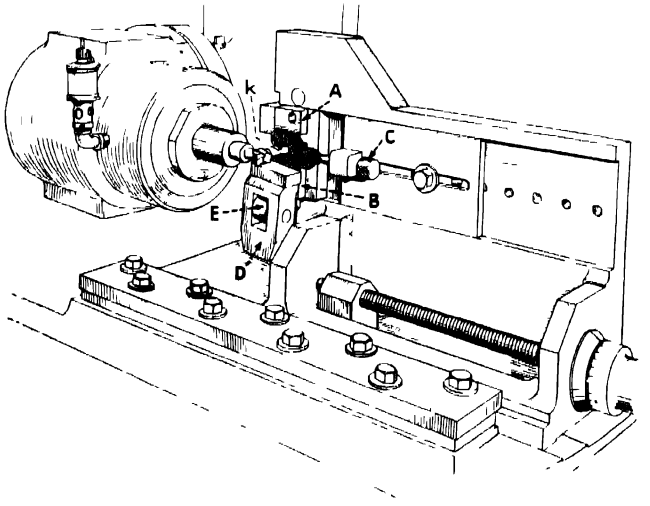
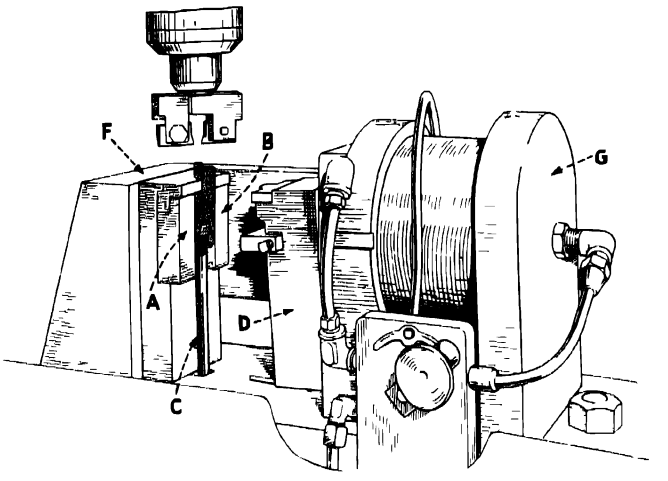


Fig. 6—The dovetail in the blade must be milled with a radius conforming to that of the rotor. Since only a few thousandths of metal is removed in this operation, the fixture has an eccentric clamp for quick application and removal of the blade

Fig. 7—When the tenon on the end of the blade is circular, rather than elliptical, the blade is held in this air-operated fixture and the metal removed with a two-blade inserted cutter. Elliptical tenons are milled in the fixture shown in Fig. 15



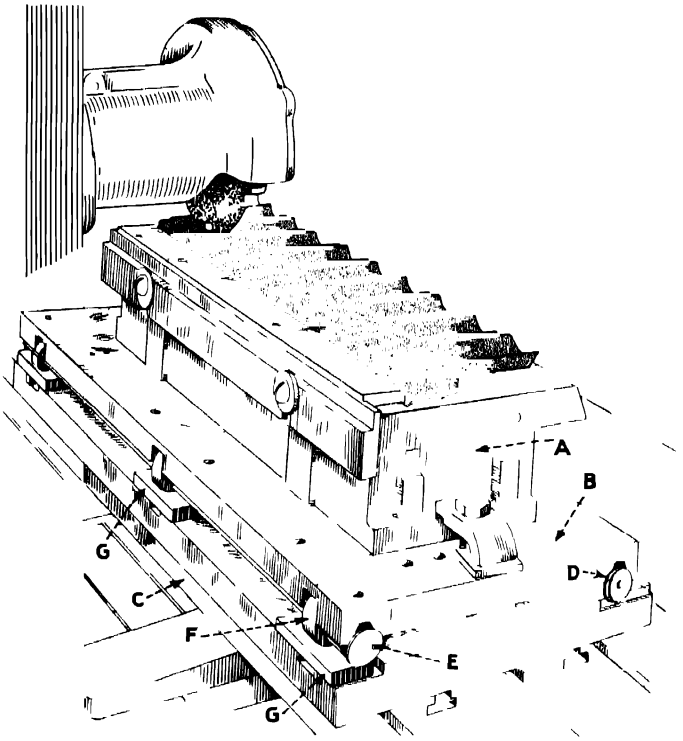
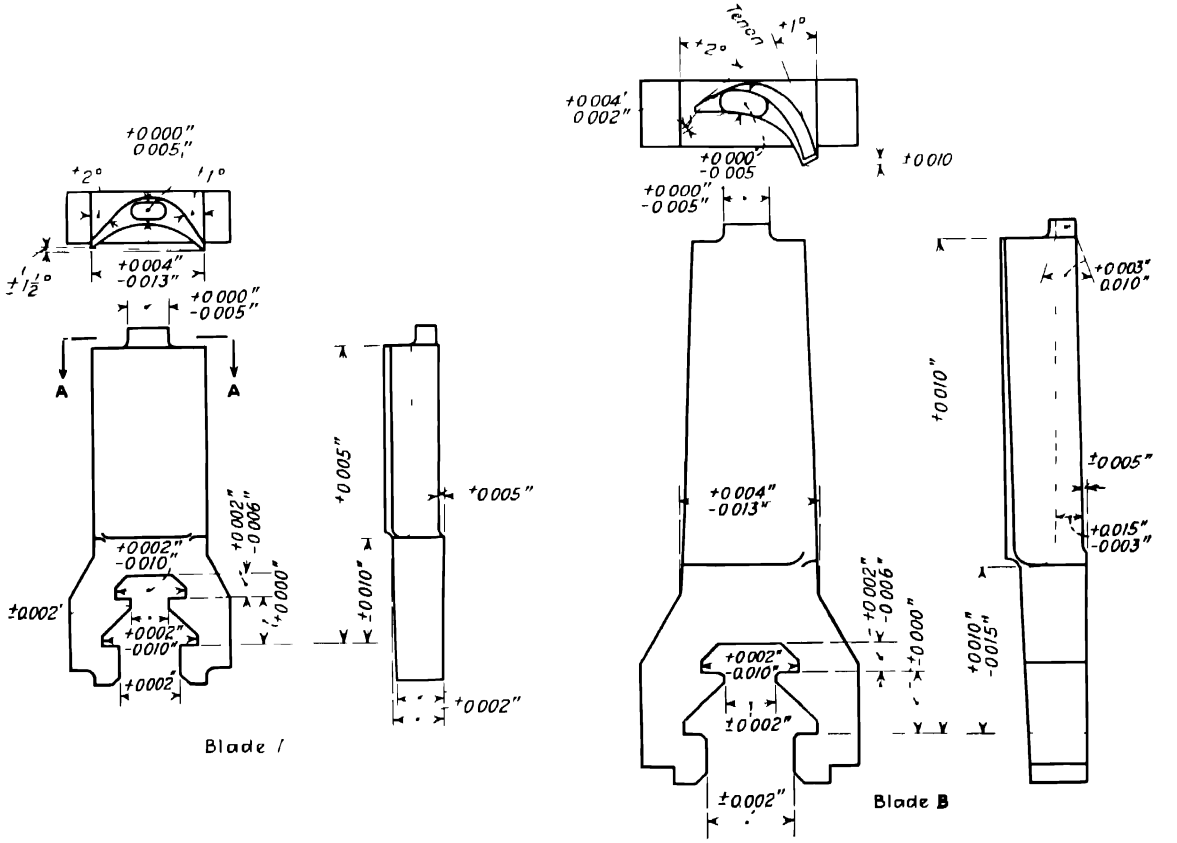


Fig 8—The taper on the root of the blades is ground to finish size. A group of blades is placed on a magnetic chuck which is tilted to an angle with sine blocks placed under one end of a hinged plate bolted to the grinder table

Fig 9—The tolerance given are typical of high pressure blades A and low pressure blades B. The tolerances are used on inspection gages, milling machine operators work only to actual finished dimensions



a magnaflux test to detect possible flaws. A drop of nitric acid is placed near the tenon to check the material—the chrome steel specified for the blades will not turn black under the action of this acid, whereas other stock in the shop, should it accidentally be used for blading, will turn black. Finally each blade is inspected with go and no-go gages for dovetail rotor fit. Gages are also provided for checking blade length, radial alignment on rotor, root dimensions and taper, contour of the convex and concave surfaces, and tenon dimensions. Permissible tolerances on two turbine blades are shown in Fig. 9.

The shape of the blades described in the foregoing operations have straight concave and convex steam-passage surfaces such as Blade *A* in Fig. 9. In some instances high-pressure blading for the last few stages may have helical concave and convex surfaces such as shown on Blade *B* in Fig. 9; in the latter case, the machining operations are similar to those performed on low-pressure blading described later. Conversely, machining operations of low-pressure blading with straight concave and convex surfaces are similar to those just described for high-pressure blading.

Low-Pressure Blading

When the low-pressure blades become helical in shape, they are usually of such length that only one blade can be machined from the original rectangular stock shown in perspective in Fig. 10. The piece is ground square on the top, bottom and sides, and both ends are faced square with ground surfaces. These three operations, as well as succeeding ones, are indicated in Fig. 10.

A group of ground and faced rectangular pieces are placed in a fixture for milling the slot in the root of the blade. This operation, indicated as No. 4 in Fig. 10, is performed in a fixture similar to that shown in Fig. 3. Operation No. 5, milling the dovetail in the root and the square on the tenon end of the blade simultaneously, is done on a Cincinnati four-spindle Hydromatic miller with the fixture shown in Fig. 11. The blades are located in the fixture by finished faces *a* and *b* shown in Fig. 10. Referring to Fig. 11, the blades

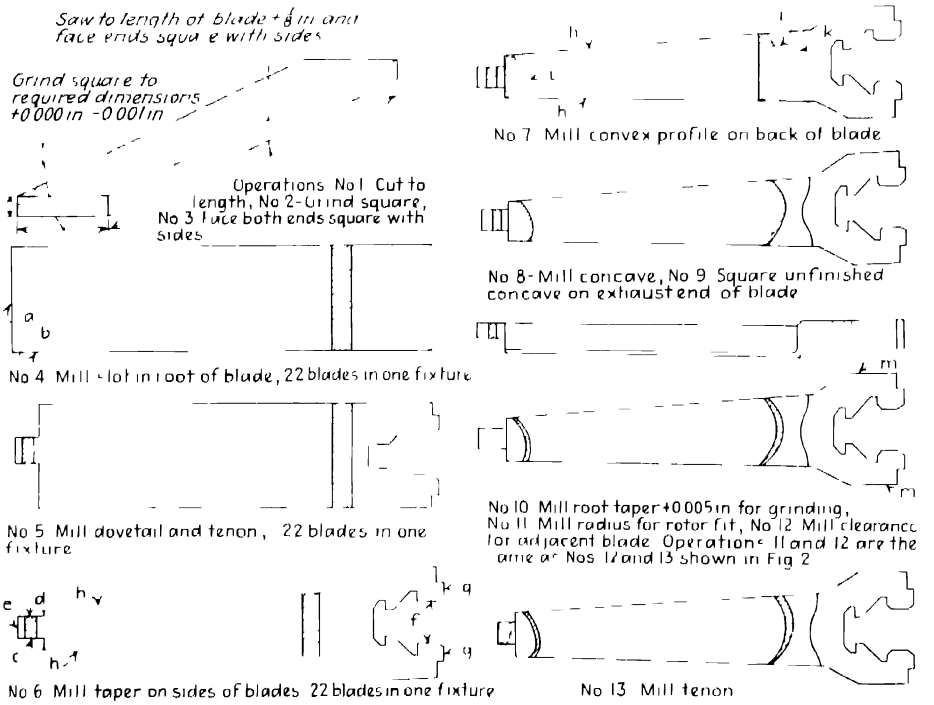


Fig. 10 These are the operations for machining low-pressure blades. Other operations are grinding root taper to finish dimensions, sanding and polishing concave and convex surfaces, magnaflux testing for flaws, nitric acid test the material, and inspect for sizes and rotor fit

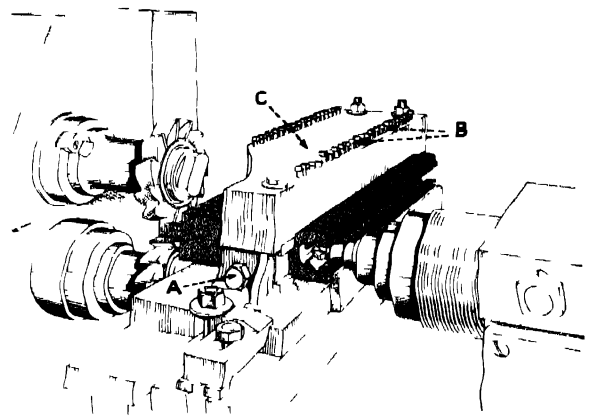
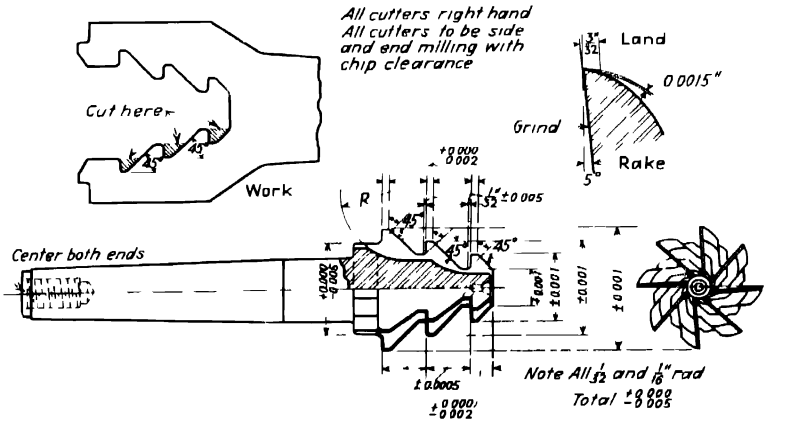


Fig 11—The dovetail and tenon end of low-pressure blades are milled on a Cincinnati four-spindle Hydromatic with 10 to 22 blades in the fixture. The cutter is for large low-pressure blades with three-step dovetails used in the last stages of the turbine





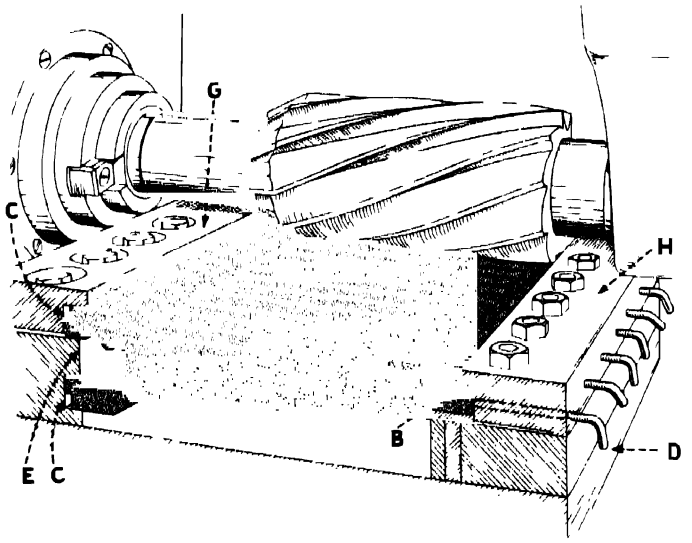
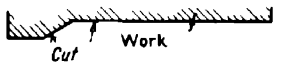
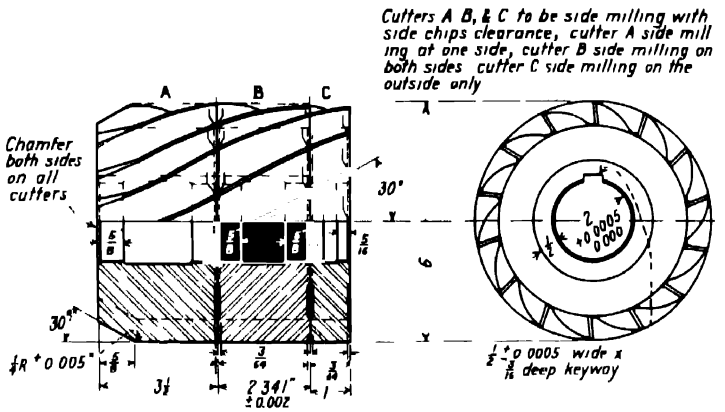


Fig 12—This fixture and cutter is for milling the taper of the sides of the blades. Liners are placed above and below the tenon because on helical shaped blades the tenon is not on the dovetail center line. Each blade is held against the back of the fixture by setscrews against the tenon end







are clamped horizontally by setscrews *A* and vertically by setscrews *B* in cap *C*, each blade being held by two setscrews. The square on the tenon end of the blade is not on the center line of the dovetail, since the finished blade is to be helical shaped like blade *B* in Fig. 9

The taper *h* on the sides of the blade, indicated by operation No. 6 in Fig. 10, is next milled with as many as 22 blades in one fixture. The blades are located in the fixture from surfaces *c*, *d*, *f* and *g* previously machined to finished dimensions The fixture is shown in Fig. 12. Liners *A* and *B* are placed above and below the tenon to maintain the

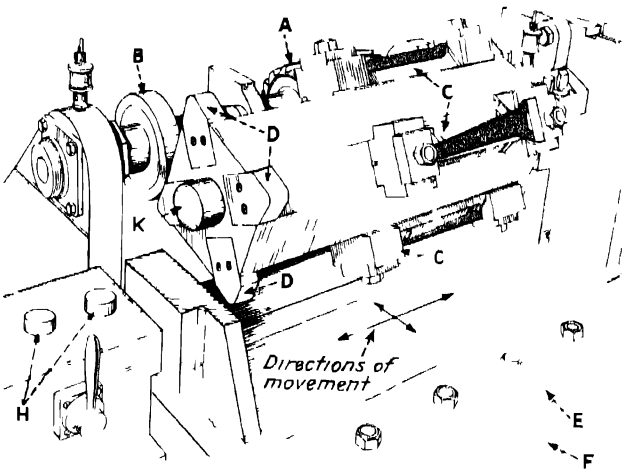




Fig 13 Low-pressure blades are profiled conces in the same fixture used for high pressure blades, but only one blade is machined from one piece of stock and the table moves both longitudinally and transversely to complete the cut The cutters are interlocked with sufficient clearance in back of the teeth to prevent the chips from clogging

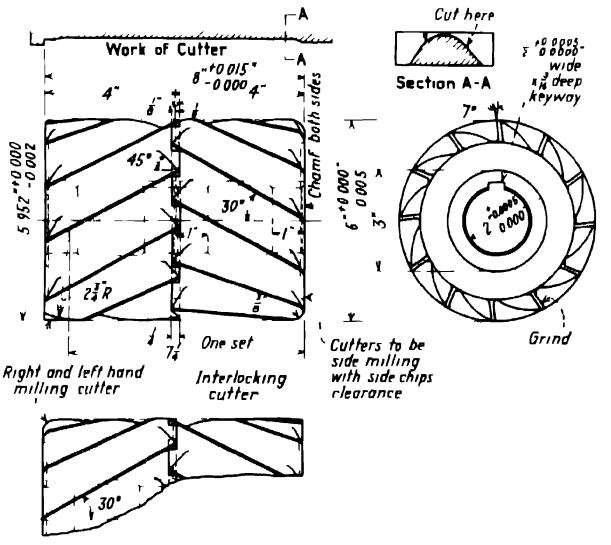
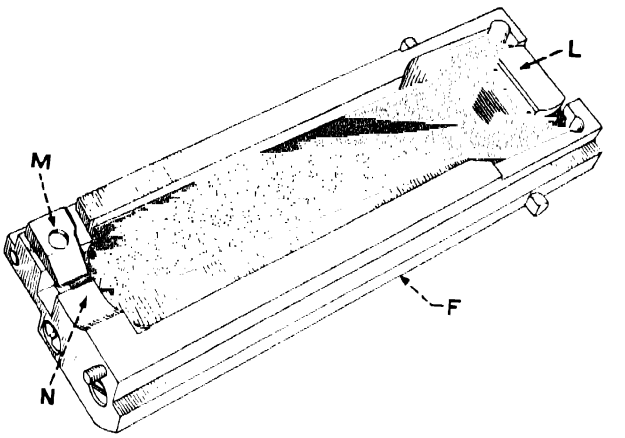
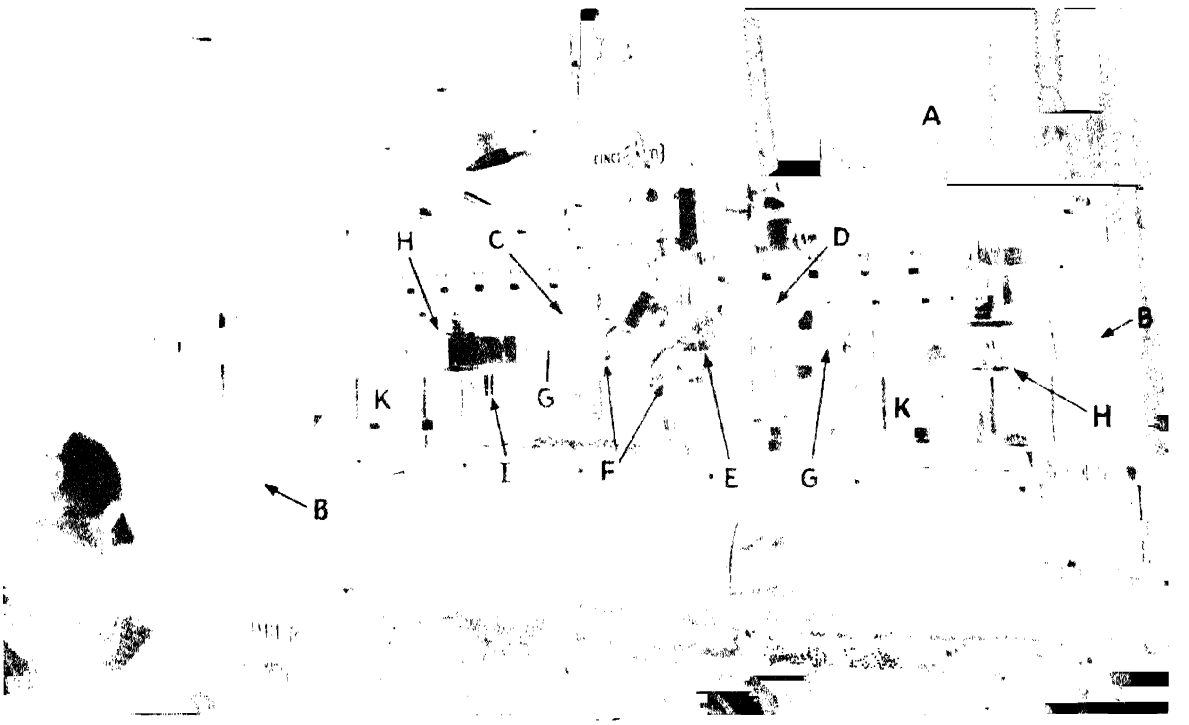
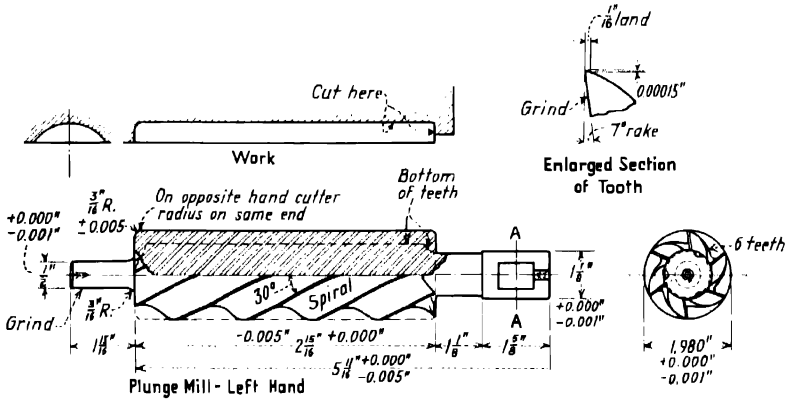
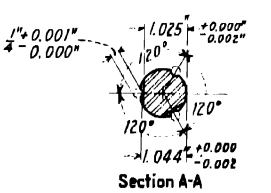


Fig. 14—The helical shaped concave faces of two low-pressure blades are plunge milled simultaneously with a straight cutter. The blade is offset in the holder to produce the helical surface. The fixture has right- and left-hand sliding heads which are advanced against the cutter by right- and left-hand cams operated from the machine table









blades in a horizontal position since the tenon is not on the dovetail center line. The blades are set flush against faces *C* of the fixture, and held there by setscrews *D* against the tenon ends. The fixed bar *E* fits the dovetail slot tightly. The blades are butted against the back of the fixture, held horizontally by screws *D* and vertically by caps *G* and *H*. Studs in Cap *G* are countersunk to clear the cutter arbor. The blades are reversed in the fixture for milling the opposite side.

Special Fixture Profiles Blades

The back or convex side of blade is profiled in fixture shown in Fig. 13, also illustrated in Fig. 1. The cams *D* are the exact contour of the blade profile desired, and bear against roller *B* on the cutter arbor by a leverage system moved by an air cylinder and controlled by differential air pressure as explained previously. The blades fit tightly into the holders *C*, the fits being along sides *c*, *d* and *e* of the tenon end, *f* of the dovetail end, and tapered sides *h*, all of which are indicated in Fig. 10. The table *F* moves backward and forward to cut the profile *i* and the table *E* moves transversely to cut the contour *k*; the cam which moves the table transversely is timed with the profile cams and produces contour *k* simultaneously with the convex surface *i*.

The concave side of helical blades is milled with the fixture shown in Fig. 14 on a Cincinnati Hydromatic milling machine. The crossbeam *A* is mounted to the overarm of the machine and supported on each side of the base by struts *B*. The center line of the crossbeam *A* is in line with the center of the cutter spindle. Two sliding heads *C* and *D*, with machined V-ways to mate ways in the crossbeam, are provided with T-slot heads *E* in which are inserted the two blade holders *F*. Heads *C* and *D* are driven by the crank motion of arms *G* connected to left- and right-hand cams *H* driven by gears *I*. Two hardened-steel racks *K*, bolted to the machine table, mesh with the gears during motion of the table. The cams on each side of the sliding heads decrease the feed of the work as it advances against the center of the cutter and

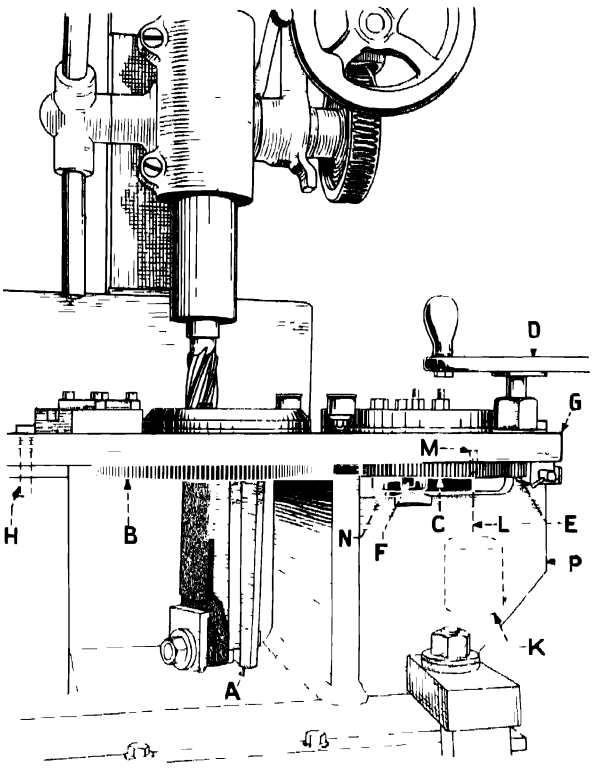


Fig. 15 Elliptical tenons are milled in a fixture with a pivoted top to which are attached a geared blade holder and a geared cam having the same shape as the tenon. The cam moves against a fixed roller which causes the top of the fixture to swivel about its fulcrum and generate a movement at the face of the cutter similar to that of the tenon cam

the finish depth required. A positive stop prevents the work from advancing more than a predetermined amount; after this, the cutter will make 30 revolutions to clean up the cut. Afterwards, the table reverses and the cam action opens the sliding heads rapidly to stop position for removal of the blades.

The blades are offset in the holders as shown in the perspective drawing in Fig. 14, the fit being along one of the tapered sides *h*, on surfaces *c*, *d* and *e* of the tenon, surfaces *f* of the dovetail slot, and surfaces *m* of the blade root; all these surfaces are shown in Fig. 10. The blade is held in the holder by swivel clamps *L* and *M*, and is forced to the left against the tapered surfaces. The plunge milling cuter revolves around the center line of the holder, and by virtue of the position of the blade in the holder mills the helical form of concave face as shown on blade *B* in Fig. 9.



Fig. 16 Each blade is checked for length, root dimensions and taper, contour of the convex and concave surfaces, and tenon dimensions Segment gages are used to check assembly and radial alignment on the rotor

Clearance for the cutter is at *N*, Fig. 14.

The last milling operation is the machining of the elliptical tenon. This is done with the fixture shown in Fig. 15. The blade is placed in holder *A* so that the tenon projects above the surface of the gear *B* exactly in the center. Gear *B* meshes with gear *C* which is hand operated with wheel *D* and pinion *E*. At the center of gear *C* is a cam *F* of hardened steel machined to the exact shape and twice the size of the tenon desired on the blade. All of these parts are rigidly attached to the plate *G* which pivots about pin *H*. To plate *G* is attached weight *K*, by means of cable *L* and sheave *M*. As the plate pivots about pin *H* it is stopped by cam *F* when the weight *K* pulls the plate against roller *N* which is set on a shaft in the solid base *P*. The distance from pivot pin *H* to the center of gear *B* is one-half the distance between the pivot and the center of gear *C*. It is because of this ratio that the tenon cam *F* is exactly twice the size of the tenon desired on the end of the blade. In operation, the machinist rotates handwheel *D* which moves the tenon cam *F* against the roller *N*, thereby causing plate *G* to swivel about the pivot *H* and generate a movement at the face of the cutter similar to that of the tenon cam as the latter turns against the roller. One complete revolution of the gear *B* is required to machine the tenon.

Finally the taper of the root of the blade is ground on the fixture shown in Fig. 8, as described previously. The blades are inspected for size and rotor fit, and tested for proper material and flaws. Some of the test gages are shown in Fig. 16.



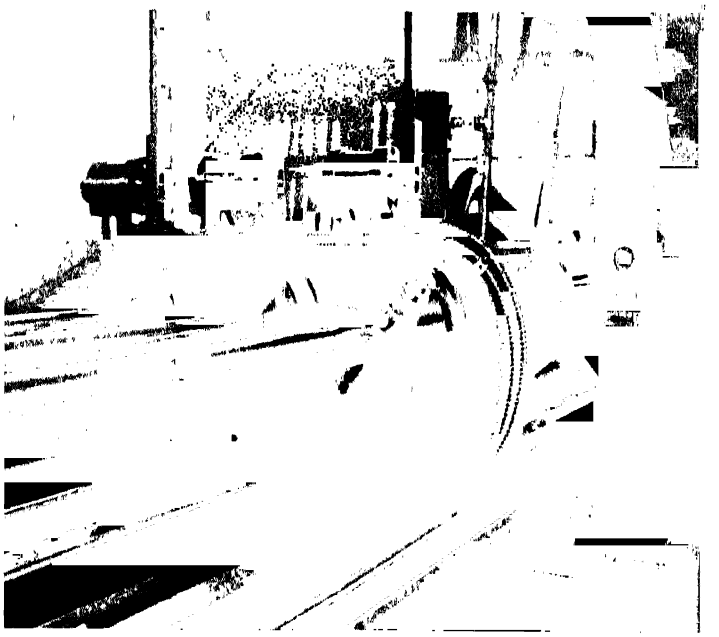
THREE CYLINDERS FROM A SINGLE LATHE

By WALTER M. SCHINDLER

Production Engineer, Bendix Aviation, Limited



Rear chuck slides back off the boring bar to permit reloading of cylindrical parts in this triple-cylinder boring lathe. Cylinders of different lengths and diameters can be bored simultaneously



Gear box is provided with three air-operated Barker wrenchless chucks. Rods underneath boring bars run from sliding work-holding tables to actuate triggers beneath chucks

HYDRAULIC CYLINDER MANUFACTURE is a special problem in aircraft air-oleo shock strut and actuating cylinder production, as the cylinders must be machined with high accuracy at a greatly accelerated rate.

Although these cylinders vary considerably as to size, most are made in a standard way. Seamless heat-treated chrome molybdenum tubing is fed through a turret lathe, machining the outside diameters—commonly consisting of a relieved center portion with raised ends. The cylinder is end faced in the turret lathe and then chucked in a lathe for boring. This operation removes $\frac{1}{32}$ to $\frac{3}{16}$ in. of metal, depending on the size of the cylinder and the tubing stock available, and the bore is then finished on a Barnes honing machine.

Chucking cylinders in the conventional way is somewhat tedious, and the boring operation is difficult to perform satisfactorily unless the boring bar is supported at both ends and carefully centered with respect to the cylinder outside diameter. The cylinder cannot be clamped too tightly or it will spring in the chuck and then be out of round after boring. To solve these problems Bendix Aviation has developed a satisfactory special lathe to bore three cylinders simultaneously. Cylinders may be of varying lengths and diameters in any given set-up, without impairing efficiency.

The first attempt to develop a machine of this type resulted in a single-spindle tool built on a Rockford lathe. This machine proved satisfactory and is still in use. The cylinder

is carried in a pair of self-centering cam clamps supported from brackets mounted on the lathe table. To set up a cylinder boring job in this machine the boring bar is flexibly fastened in the spindle and steel centering rings are slipped along the bar so that the self-centering clamps may be tightened to center the boring bar. The two sets of three support rollers are now adjusted tight against the bar at each bracket. The upper roller is then loosened, the support bracket drawn back, the steel bushings removed and the cylinder slipped in place and clamped by the two self-centering cam clamps. The roller supports are automatically returned to position, being mounted on the cylinder clamp support brackets, and the top roller on each bracket is tightened back until it just contacts the bar. This method results in accuracy, but it is too slow.

The triple-cylinder boring lathe was developed as a result of the experience gained in designing, building, and operating the tool just described. This machine, built on a 16-ft. lathe bed, permits boring any size cylinder from 1 in. diameter and 6 in. long, up to 6 in. diameter and 40 in. long. These two extremes can be bored at the same time if necessary, although normal operation calls for set-ups of cylinders of the same size.

A special gear box drives three Barker wrenchless chucks which grip the boring bars. A special table carries three pairs of brackets which are dovetailed to the table for adjustment to cylinder lengths. The tail brackets slide back off the end of the boring bars and swivel for quick removal of the work. Each of the six cylinder-support brackets carries a chuck and a set of three boring bar support rollers. After selection of the appropriate boring bars for the cylinders to be machined, the bars are chucked in the wrenchless chucks and then both cylinder support chucks are tightened against each bar. While the chucks hold the bars in position the bar support rollers are adjusted snugly against them. The chucks are then released, the cylinders inserted and chucked, and the work is ready to proceed. The upper of the three support rollers is released to slide the rear chuck and bracket off the bar for work handling. The table supporting the brackets feeds away from the lathe head during the boring operation so that, when the work is finished, the rear bracket is near the end of the bar and removal of the work is simplified. Total load and unload time for three cylinders averages not more than fifteen minutes. Time to make a new set-up runs between one and two hours. The cutting tool is a Davis expanding block cutter held in a slot in the boring bar by a single centering screw which permits quick tool removal for cylinder loading.

The chucks in the gear box which drive the boring bars can be operated while running by an air cylinder control or by hand. Each boring operation is controlled by a suitable cam carried on a rod running from the lathe table to the lathe chuck air valve trigger. As the table moves out each cam is brought into contact with the trigger when boring is finished. The corresponding chuck then releases automatically and its boring bar lies idle in its support rollers, moving with the table, until the remaining boring operations are concluded. Of course, when the cylinders are all equal length, operation of the wrenchless chuck controls is practically simultaneous.

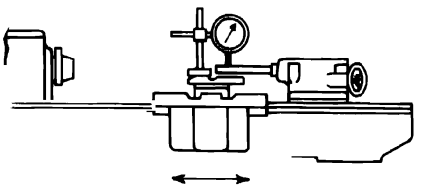
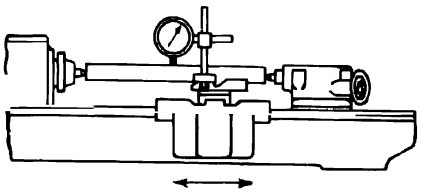
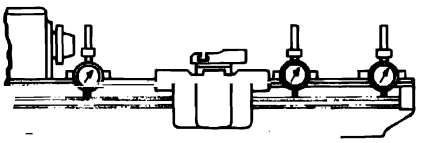
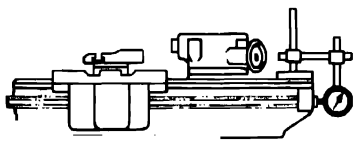
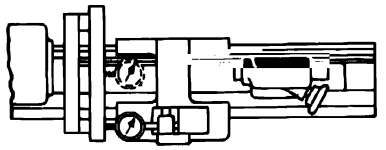
Since some cylinders are quite long the chip removal problem is serious. To solve it coolant is pumped through each boring bar to an outlet at the tool under 50 lb. pressure, which carries away chips satisfactorily. Space is provided between the cylinder chuck and boring bar support rollers to permit these chips to escape. To avoid splashing from the high-pressure oil system as each boring bar is released, a separate micro-switch control on each chuck stops the motor driving the coolant pump for that particular boring bar. Coolant oil flows back to a 30-gal. tank, where chips settle out before the oil reaches the screens protecting the pumps. Oil is fed into the gear shafts which carry the chucks by oil boxes having two oil seals each, through radial holes into the shafts, then inside the chuck and from there into the boring bar. The same gear shafts also carry adjustable friction brakes to keep gear backlash from the boring bars. The hollow boring bars are sealed in the chuck by a set of National oil seals, the bar being thrust into position through the seals when it is chucked. All boring bars have the same diameter at the chucking end so that the oil seals do not need to be changed. The boring bar support rollers are also protected by seals to keep chips from damaging them.

AMERICAN MACHINIST REFERENCE BOOK SHEET

Standards of Accuracy for Engine Lathes—II

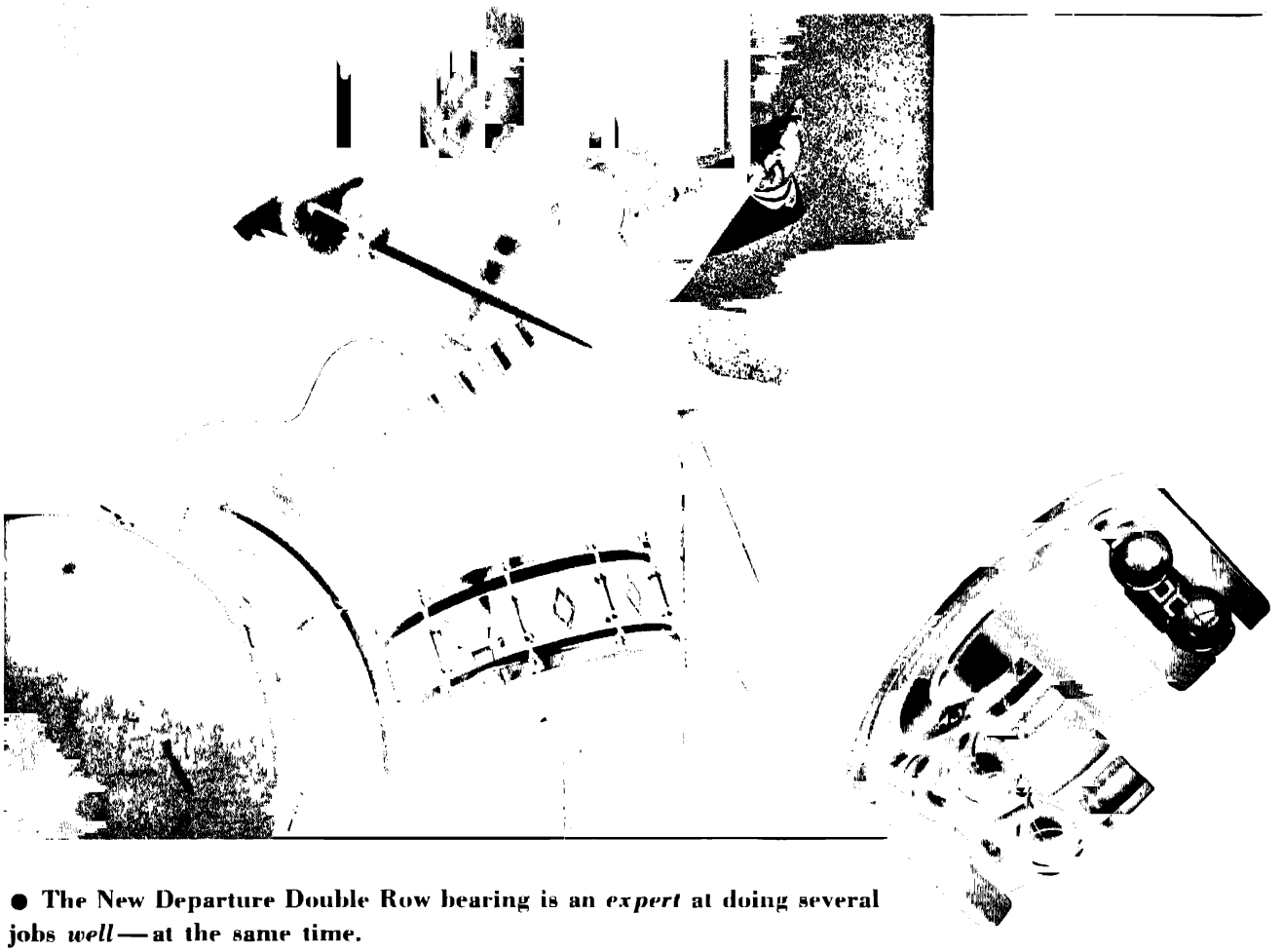
Courtesy of the National Machine Tool Builders' Association

The following concludes (Part I—*AM.* Vol. 84, page 987) standards of accuracy drawn up and adopted by the builders of engine lathes, members of the National Machine Tool Builders' Association. The standards give tolerances to which the industry is building toolroom and engine lathes, and tests for tolerances.

TEST	RECOMMENDED STANDARDS		
	Toolroom lathes	12 to 18 in. engine lathes	20 to 36 in. engine lathes
 *Tailstock taper alignment, vertical*	High at end of 12-in. test bar, 0 to 0.0005 in.	High at end of 12-in. test bar, 0 to 0.0008 in.	High at end of 12-in. test bar, 0 to 0.0015 in.
 *Vertical alignment of headstock and tailstock centers*	High at tailstock, 0 to 0.0008 in.	High at tailstock, 0 to 0.001 in.	High at tailstock, 0 to 0.0015 in.
 *Lead screw alignment — readings for base length bed taken with lead screw stationary. Add 0.001 in. for each additional 4 ft. of bed length*	Parallel with ways; 0 to 0.004 in. horizontal; 0 to 0.004 in. vertical; alignment at half nut, horizontal or vertical, 0 to 0.006 in.	Parallel with ways; 0 to 0.004 in. horizontal; 0 to 0.004 in. vertical; alignment at half nut, horizontal or vertical, 0 to 0.006 in.	Parallel with ways; 0 to 0.006 in. horizontal; 0 to 0.006 in. vertical; alignment at half nut, horizontal or vertical, 0 to 0.008 in.
 *Lead screw cam action*	Maximum, 0.0003 in.	Maximum, 0.0004 in.	Maximum, 0.0005 in.
 *Cross-slide alignment*	To face hollow or concave only on 12 in. diameter, 0 to 0.0005 in.	To face hollow or concave only on 12 in. diameter, 0 to 0.001 in.	To face hollow or concave only on 12 in. diameter, 0 to 0.001 in.
Backlash on crossfeed:			
Screw	0.001 in.	0.004 in.	0.005 in.
On compound-rest screw	0.004 in.	0.004 in.	0.005 in.

Like a ONE MAN BAND

. . . *this multi-purpose bearing*



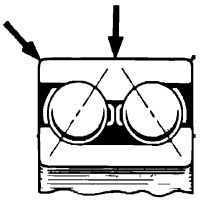
● The New Departure Double Row bearing is an *expert* at doing several jobs *well*—at the same time.

It resists radial and thrust loads in *any combination*, with thrust in either direction or reversing . . . provides extremely rigid support under pure radial loads.

It resists misalignment so positively, that in many cases it may be used alone, without need for a second or supporting bearing.

It is a compact, internally preloaded *unit*, applicable in numerous instances *without* need for shaft threads or locknuts.

Here is a truly versatile bearing. Use it to simplify your design. Let it help to save you money and build a better product. 2941



TWO JOBS—ONE BEARING

Big advantages in economy of manufacture and machine performance result from the use of the Angular Contact Double Row ball bearing *which was originated by New Departure* to resist both radial and thrust loads

Today automobiles, trucks, tractors and machinery of many kinds depend upon bearings developed by New Departure from this original dual purpose "new departure"

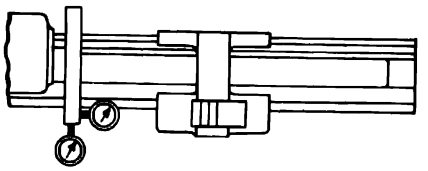
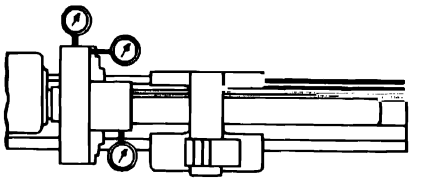
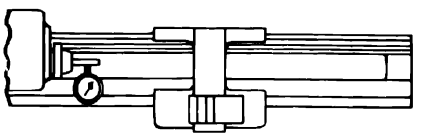
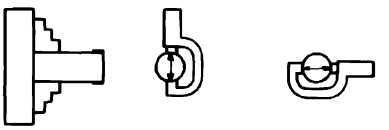
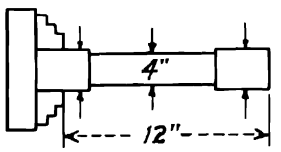
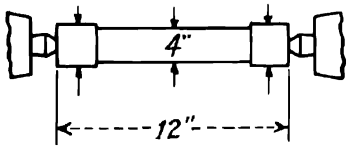
NEW DEPARTURE

THE FORGED STEEL BEARING

NEW DEPARTURE - DIVISION OF GENERAL MOTORS BRISTOL, CONNECTICUT DETROIT CHICAGO

AMERICAN MACHINIST REFERENCE BOOK SHEET

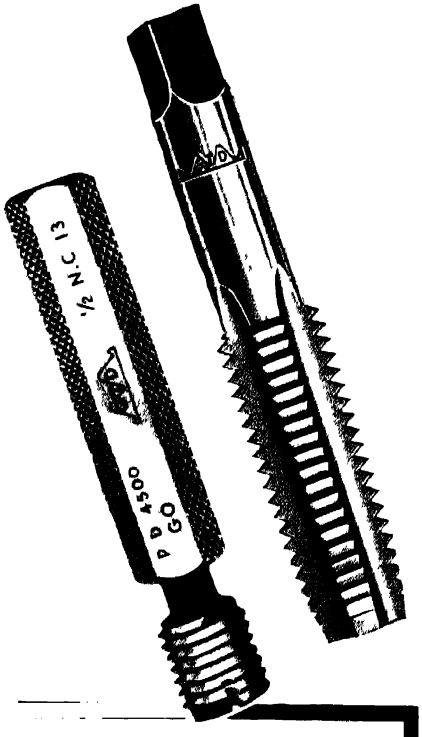
Standards of Accuracy for Engine Lathes—II

TEST	RECOMMENDED STANDARDS — Toolroom lathes	12 to 18 in engine lathes	20 to 36 in engine lathes
 *Face plate run-out*	On diameter, 0 to 0 0005 in , on face at nominal diameter 0 to 0 001 in	On diameter, 0 to 0 001 in ; on face at nominal diameter, 0 to 0 0015 in	On diameter, 0 to 0 0015 in ; on face at nominal diameter, 0 to 0 002 in
 *Chuck run-out*	Face and periphery, 0 003 in , face of steps, 0 003 in , bar test 3 in from end of jaw, bar diameter same as hole, 0 003 in	Face and periphery, 0 003 in , face of steps, 0 003 in , bar test 3 in from end of jaw, bar diameter same as hole, 0 003 in	Face and periphery, 0 004 in ; face of steps, 0 004 in ; bar test 3 in from end of jaw, bar diameter same as hole, 0 004 in
 *Collet chuck run-out*	1 in from spindle, 0 to 0 001 in	1 in from spindle, 0 to 0 001 in	1 in from spindle, 0 to 0 001 in
 *Lathe must turn round with work mounted in chuck*	0 0003 in	0 0001 in	0 0008 in
 *Lathe must turn cylindrical with work mounted in chuck*	0 0008 in	0 0015 in	0.002 in
 *Lathe must turn cylindrical with work mounted between centers*	0 0004 in.	0 0008 in.	0 001 in
Lead screw:			
Lead per foot . .	±0 001 in	±0 0015 in.	+0 002 in
Lead in any 4 in	±0 0004 in	+0 0005 in	±0 0007 in.

This workman is using a 5/16–24 "G T D. Greenfield" Ground Thread Tap—turning it with a "G T D. Greenfield" Tap Wrench, and testing the hole with a "G T D. Greenfield" Plug Thread Gage.



Here's a Tough Job!



For Accuracy: "G.T.D. Greenfield" Precision Ground Taps and Precision Thread Gages.

This looks like aluminum—actually it's chrome molybdenum steel, No. 4682З, tensile strength, 180,000 lbs. It's an elbow assembly for aeroplane landing gears and production conditions require a hand operation with precision ground thread taps. We are told that production is only 60 holes per tap, and taps have to be sharpened after every 10 holes. Pretty low! Well, before "GTD Greenfield" taps were used the production was only 35 holes per tap with 6 holes between grinds.

The fact that *"Greenfield"* taps excel on extremely tough assignments is extra assurance that they will turn in equally superior performances on easier jobs. Don't you want to arrange a test?

GREENFIELD TAP & DIE CORPORATION, Greenfield, Mass.

Detroit Plant 2102 West Fort St. Warehouses in New York, Chicago Los Angeles and San Francisco. In Canada, Greenfield Tap & Die Corp. of Canada, Ltd Galt, Ont.

GTD GREENFIELD

TAPS · DIES · GAGES · TWIST DRILLS · REAMERS · SCREW PLATES · PIPE TOOLS

Put All Idle Machines To Work

HOW TO GET the armament job done the quickest way is still the country's No. 1 problem. In view of the critical state of the world, that problem overshadows all others.

An important part of that problem is to get increased machining capacity in the munitions and aircraft industries. Suddenly the demand for machine tools has descended like an avalanche in devastating fashion.

To meet the immediate situation, ingenuity must be used. Machine tool builders are doing magnificent work in shouldering a staggering load. Their story has already been told in these columns. But it would be unfair to the defense program and harmful to the nation's interests if every defense contractor sat back and waited for new tools before he began operations.

Fortunately, most companies are not doing that. They are resorting to the process of farming out work to achieve results in a hurry. In that way they bring into use idle or partially employed machinery in non-essential industries, spread production and work and payrolls more evenly throughout the country, and push ahead the entire program.

Still other avenues for quickening the armament production pace are open.

Every shop man knows that there is more than one way of doing every machining job. You may have your heart set on that battery of new XYZ machines. That's no reason, though, why you shouldn't shift the work over onto some old ABC machines until you can get what you want. Better a makeshift which will turn out 70 per cent of your anticipated quota than no production at all.

Another point somewhat along the same line: by all means let's put to work every available machine to do the enormous job just ahead. If you have any idle machinery in your plant, we suggest that you survey the possibilities ahead to see whether you will be using it in the next five or six months. If not, you can be of great service by releasing such equipment to those who are engaged in defense manufacture.

Much machinery, though it has seen considerable service, can be rebuilt or retooled for a defense job with a minimum of delay. Plants which can competently put those machines rapidly into shape for the new tasks exist in this country.

A further word. If your machine shop is not running full, you can be of valuable assistance to the government by seeking a sub-contract in connection with defense work.

It is just as vital to our defense today to put back to work all the idle machines as all the idle men. Not until that is done can we say that the armament program is operating at the highest degree of efficiency.

Burnham Finney

GAGING BUSINESS

Metal-working operations expanding as sub-contracting takes up slack capacity. Available used machinery reported scarce. British and Canadian machine tool orders total $100,000,000.

Employment and payrolls in the metal-working field are rapidly expanding in almost all parts of the country as the sub-contracting of defense work takes up whatever slack exists in the nation's thousands of machine shops. Idle machines as well as idle men are now being employed at the task of speeding up the armament program.

Machine Tools—Incoming orders continue in tremendous proportions, though in many cases the volume in November was less than in October. Bookings, however, still are greater than production, despite recent extensive expansion of plant capacity and of output. The industry's backlog is now in the neighborhood of $400,000,000. Operations today are at a rate close to $500,000,000 a year. Even with long deliveries prevailing, the industry is estimated to be in a position to take over $50,000,000 of business for shipment prior to next August 1. British and Canadian orders on hand in this country are just under $100,000,000. If defense requirements are known in advance so that production scheduling can be done to the best advantage, machine tool builders will be able to turn out $650,000,000 of machines in 1941. Good used machinery available for sale is reported scarce. Companies with machines which they do not expect to use for many months, if at all, are being urged to release them to be rebuilt for companies with munitions contracts.

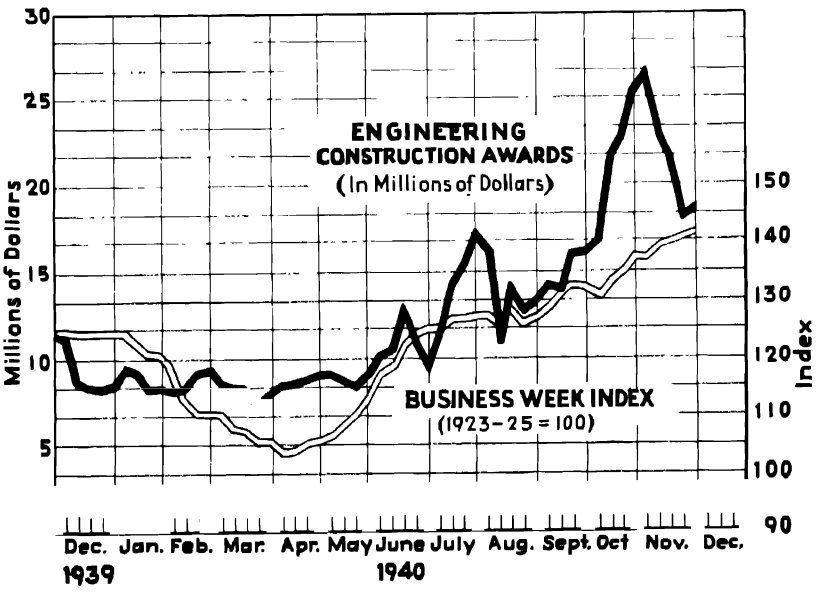
Munitions—Less than half of the $850,000,000 available to the War Department for government-financed munitions plants has been contracted for. At least $50,000,000 in additional contracts are looked for soon. Only one heavy gun factory has thus far been officially decided upon. Lack of skilled personnel to design, build and operate the proposed munitions plants is reported the main factor holding up progress. Increased size of plants, thereby reducing the total number required, has only partially solved the problem. Westinghouse is to make gun mounts and big guns for the Navy at a new factory to be built near Louisville, Ky. Lima Locomotive Works, Lima Ohio, will manufacture gun carriages in a new plant. The War Department has placed contracts for $9,956,000 of artillery material with the Koppers Co., Pittsburgh. Awards for ammunition components have totaled $8,546,179 of which $4,231,240 will be furnished by the Scoville Mfg. Co. Otis Elevator Co. will turn out $2,722,679 of artillery material at its large plant located in Yonkers, N. Y.

Aviation—Unfilled orders for airplanes and engines are close to $3,500,000,000. Deliveries of planes this year will amount to $625,000,000, against $225,000,000 in 1939. Today the industry has 164,000 shop employees; the number will be increased to 382,000 six months from now (not counting in sub-contractors). In the last 12 months aircraft makers have spent $83,000,000 for plant expansion and have let contracts for an additional $232,000,000 to be ready next June. Buick and Studebaker are both said to be preparing to make airplane engines. The grandiose scheme for producing huge quantities of plane parts in the automotive industry is still mostly in the "talk" stage.

Railway Equipment — November orders for about 8,000 freight cars and 35 locomotives will raise the year's total to approximately 56,000 cars and 425 locomotives. That volume is well above any year since 1929 with the exception of 1936. Meanwhile railway equipment suppliers are deep in defense activities. American Car & Foundry, to cite a single example, has a backlog of $115,611,801 of which $93,000,000 is for munitions products for the United States and Great Britain.

Farm Equipment—Manufacture of tractors and farm implements for the spring season is starting. The National Communal Farm Credit Bank of Mexico has contracted for $104,250 of tractors and other equipment from Minneapolis-Moline Power Implement Co.

Steel—Major expansion programs announced by Bethlehem and Tennessee Coal, Iron & Railroad are believed to be the forerunner of similar action by other steel companies. A. M. Byers will begin production within six months of a broad line of alloy steels, including stainless. American Rolling Mill and Youngstown Sheet & Tube are inaugurating mill enlargement or modernization operations. Much of the construction is an answer to the Defense Commission's and the Administration's pleas for greater ingot capacity to meet demands not only for armament, but also for non-munitions products. Now at 97 per cent, the industry is expected to produce close to 70,000,000 tons of ingots this year.



Plan to Band Together Smallest Industries for Defense Work

WASHINGTON—While Donald Nelson's small business activities committee is setting up machinery to give financing and advice to smaller firms that want defense contracts, Commissioner Hillman has given Morris L. Cooke the job of pushing down even farther into industry to reach the firm that has only a few machine tools, a little unused capacity, a few extra men, particularly in the "ghost towns" that have been left stranded by migration of industry. The plan is to get these firms in each community to band together into an organization which can pool facilities and handle a substantial volume of parts manufacture. Cooke's committee, a promotional outfit, has made sampling surveys of available facilities, is pushing formation of community groups (about six so far), and will soon circulate specimen blueprints of the sort of parts likely to be needed. Actual negotiation of contracts, of course, will lie with the prime contractors and the local councils, but Cooke is trying to maintain liaison. First major application of the plan will be in the pending expansion of shipyard facilities. Prime motive is solely to give the defense program the greatest influence on unemployment and to minimize concentration of war industries into big centers.

Machine Tool Builders Expand Plant Capacity Sharply to Meet Defense and British Needs

CLEVELAND—Within one year from the day England and Germany went to war the machine tool industry of the United States had doubled its production, and in 1941 output will reach $600,000,000, says a statement of the National Machine Tool Builders' Association. The statement is based on a survey participated in by 115 companies comprising 80 per cent of the industry's capacity.

The survey reveals that the defense burden is not falling equally on all plants. Certain types of machines are in great demand, out of all proportion to the normal needs of industry, and it is these plants which have increased their physical capacity as well as their man-hours. Of the 115 companies, 65 reported additions to factories since September, 1939. Those additions represent 30 per cent of existing manufacturing area. And the process of expansion is continuing. In some cases space hitherto unused or devoted to less important work, or to storage, has been quickly adapted to machine tool production.

Total new equipment installed by the industry since the start of the defense program is estimated at more than $30,000,000. The industry's employment is put at about 80,000 men. Increased productivity has been accomplished chiefly by maximum use of existing and of newly installed equipment through a remarkable program of employment and training of men. Two years ago the industry employed less than 40,000. The startling fact is that almost half of the nation's machine tool employees today have been trained on the job since September, 1939. Common to most of the training programs are these features: (1) short-term learners' training is carefully distinguished from long-term apprentice training; (2) there is widespread cooperation with trade schools and vocational high schools; and (3) actual training is done *on the plant floor*.

Increased machine tool productivity also has been secured by sub-contracting work. Of 115 companies surveyed, 86 reported sub-contracting in some form. Eighty are sub-contracting parts, 33 sub-assemblies, and 23 whole machines. This procedure gives employment to hundreds of plants and thousands of men not engaged in essential work and increases output without creating new problems of housing and of investment.

New Lathe Developed

To meet the special needs of defense contractors the machine tool industry has been designing and developing much special equipment and tooling, according to the survey. One company has developed a new lathe for simultaneous turning and boring of anti-aircraft guns in advance of any order or commitment from the government. Another company has developed machines for use in the manufacture of tank clutches and has furnished the government complete engineering drawings and specifications covering clutches for three tanks. A third firm has designed special machinery for production of mechanical time fuses. Still another company has developed primarily for ordnance manufacture special long bore honing tools for gun bores and for recoil and recuperator cylinders. One builder has designed new types of gearing for optical instruments used in connection with gunfire control, searchlights and transport work.

In addition to many projects such as those outlined, several machine tool companies loaned designers to the association office to prepare for the Ordnance Department of the U. S. Army complete working drawings for two lines of single-purpose shell-making machines. These drawings are now the property of the government. They enable the Ordnance Department in time of emergency to secure large numbers of machines in a short time built in metal-working plants not otherwise engaged in essential



Guns For U. S. Defense—*Rate of production has been increased in many U. S. arsenals which are building big guns for defense. At Watervliet Arsenal (above) workers are busy turning and boring major calibre guns*

TOOL WORK DISTRIBUTION

CLEVELAND—Almost all work now being done by the machine tool industry is for defense purposes or for the British. Typical of order books is that of one company which on October 14 had the following business in hand:

	Per Cent
England	16.9
Canada	11.6
Other British Dominions	.21
U. S. Navy	6.4
U. S. Army	3.3
U. S. Air Corps	3.7
Aviation Mfrs.	25.1
National Defense Contractors	27.0
Machine tool builders	2.2
Miscellaneous	3.3

work. The first machines of these designs have been built and tested with excellent results (by Studebaker Corp. and Harris-Seybold-Potter Co.).

The survey, which stated that production this year will exceed $400,000,000, was made to obtain more detailed information as to ways and means whereby increased output has been accomplished, the relationship between machine tools and national defense, and the nature and extent of the industry's cooperation with the government and with manufacturers of defense equipment in helping to solve the technical problems involved.

Aircraft Research Plant Seen As Small Effect on Armament

WASHINGTON—Aircraft engine research by the National Advisory Committee's laboratory to be built at Cleveland can have little effect on the present armament program. Some phases of the $8,400,000 engine plant will be completed within a year, but its full effect cannot be realized for two or three years.

The laboratory has six major units: Power plant; power plant wind tunnel; engine torque stand; fuels, lubricants and instruments; hangar and adminstration. During the past ten years the power output of airplane engines has been doubled without increasing the weight. NACA wants to continue this reduction. Among other aircraft power plant improvements wanted: Harness exhaust gas to aid plane propulsion; improve supercharging for wide range of altitudes; improve fuels to increase horsepower; find alloys to withstand additional stresses; advance the diesel engine for air use; work out a gasoline fuel injection system; prevent carburetor ice; advance the direct gas propulsion principle or "rocket" plane; and improve constant-speed and feathering characteristics of propellers.

Effect of Armament Program and Post-War Adjustment Plans Feature A.S.M.E. Meeting

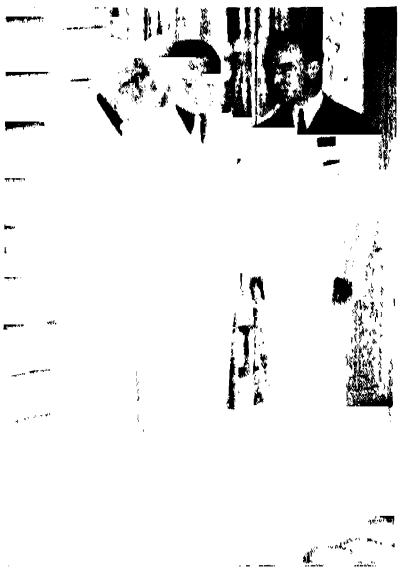
NEW YORK—A proposal to set up immediately a board of planning and research through which industries expanded beyond normal may be regeared to produce a higher standard of living during peace time was made to the American Society of Mechanical Engineers at its annual meeting. It was advanced by William L. Batt, aid to Edward R. Stettinius, Jr., member of the National Defense Advisory Council in charge of the Industrial Materials Division. According to Mr. Batt, such a plan would determine what to do with the excess manufacturing capacity which we are creating as a result of our armament program, where to find jobs for the men we are training for the production of wartime material, who is to own and operate the plants the government is building or subsidizing, and what to do about the federal debt incurred by necessarily huge expenditures for defense.

Mr. Batt's proposal was the highlight of an annual meeting attended by 5,000 engineers and executives. Included in the program were 100 technical papers presented at 50 separate sessions of various divisions and research committees of the Society. Many of the papers were devoted to phases of the National Defense Program.

R. F. Gagg, assistant chief engineer, Wright Aeronautical Corp., stated that when plans now under way are completed the combined output of American aircraft engine



Edward A. Muller, president, King Machine Tool Company is apparently enjoying the circus which was an entertainment feature at the annual A.S.M.E. meeting at Hotel Astor



William A. Hanley, right, inducted as A.S.M.E. president at the Society's annual dinner December 4, is greeted by retiring president W. H. McBryde as secretary C. E. Davies looks on

builders will be fifteen times their capacity during the summer of 1939. This will be accomplished, according to Mr. Gagg, with no sacrifice in the technical performance and durability of the product. The plans call for cooperation between the automobile, aircraft and machine-tool industries, and in this regard the results have already been gratifying. Combined efforts of these groups, and also of technicians, supervisors and workers in all the industries involved, will enable the engine builders to reach production peaks when the plans are consummated.

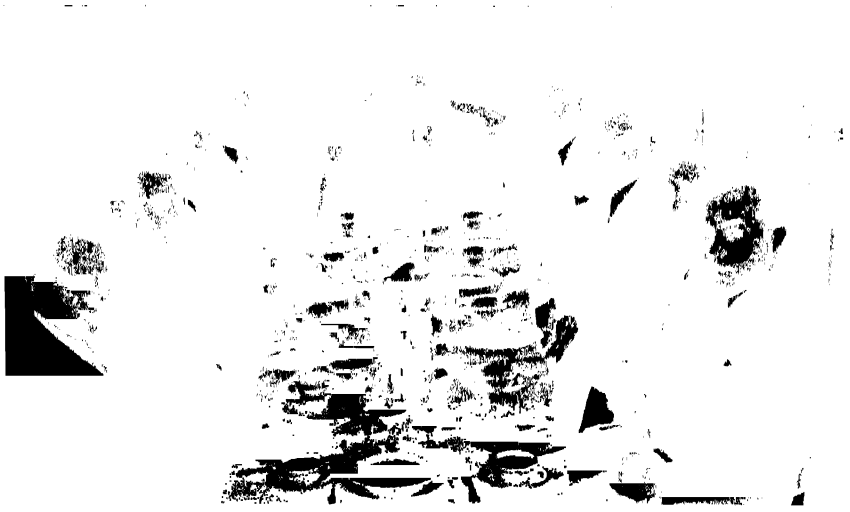
Many of the papers revealed the industrial gains to be expected from efforts in the armament program. Albert B. Cudebec, British engineer, stated stainless steel, nickel alloys and other materials of both ferrous and nonferrous types that do not work well after rolling or welding are now being shaped faster and more economically by extrusion presses. He said the development will make possible the substitution of special alloys for heavier metals. Although devised primarily for improvement in aircraft design, Mr. Cudebec stated its application to peace-time products will probably create another large industry in this country.

Ross Cunn of the Naval Research Laboratory, Washington, D. C., described equipment of recent design for detecting surface and submerged flaws in non-magnetic material. Such detection is done by establishing a pre-

determined pattern of electrical eddy currents in a perfect test sample of the material to be tested, and checking the results against eddy currents in parts in production.

The shortage of engineers, technicians and skilled workers was reviewed for the engineers by Dean A. A. Potter of Purdue University. He stated the 165 U. S. institutions offering instruction leading to engineering degrees can be utilized to promote training of these men by (1) holding classes for groups in industrial areas where many students can gather to avail themselves of educational equipment, (2) promoting extension courses by colleges in sparsely populated sections of the country, and (3) intensifying resident programs of study varying in duration from one to eight months. Legislation is now pending before Congress which will provide a fund to facilitate such training.

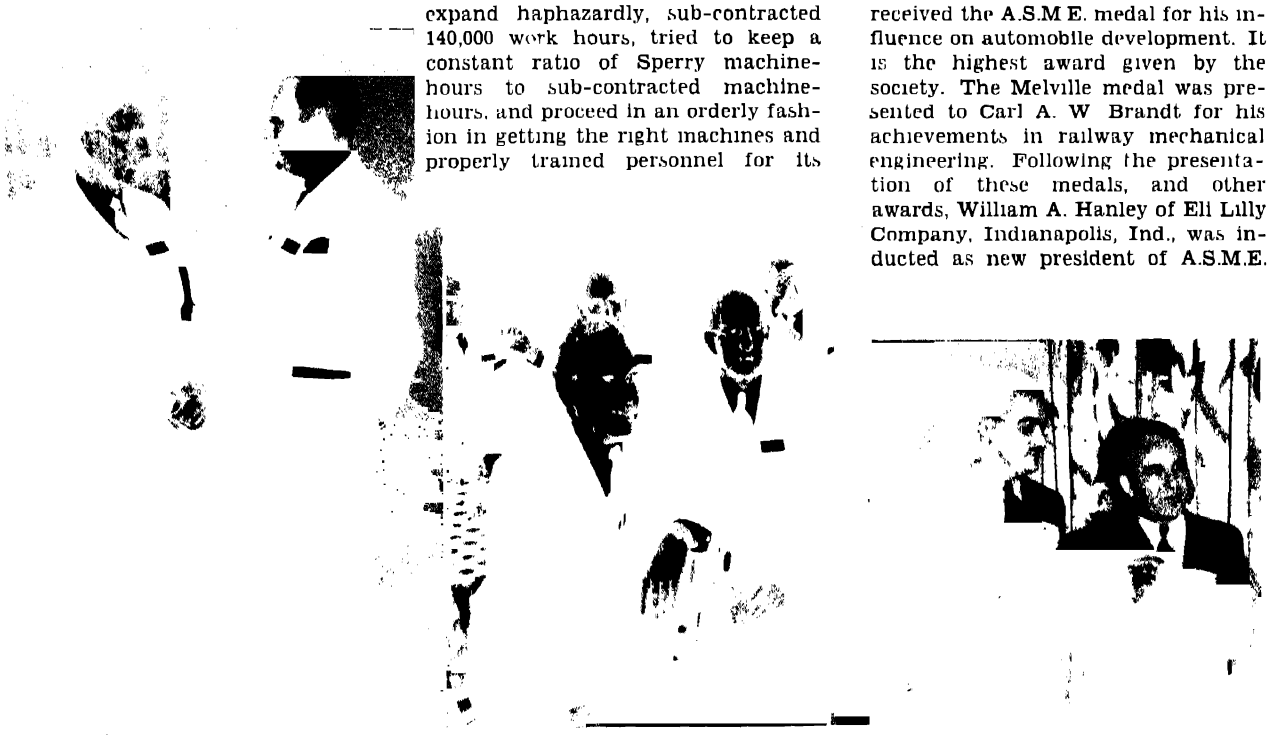
Among many lubrication problems discussed at the meeting were those encountered due to new materials in machine construction, including plastics, monel metal, stainless steel, and lead-copper and cadmium-silver alloys. V. I. Palmer of Eastman Kodak Company states a sound-recording apparatus had been developed to detect bearing failures. It is based on the principle that bearing wear is accompanied by increase in running temperatures which induce sound changes characteristic of imminent failure.



The committees on cutting fluids and cutting of metals meet at lunch. Left to right—F. J. Schmitt and W. H. Oldacre, D. A. Stuart Oil Company; L. N. Gulick, University of Pennsylvania; C. B. LePage, assistant secretary, A.S.M.E.; Malcom F. Judkins, Firth-Sterling Steel Company; O. W. Boston, University of Michigan; H. L. Moir and R. F. Overlock, The Pure Oil Company; and Dr. M. E. Martellotti, Cincinnati Milling Machine Company

Machine line production of aircraft materials was discussed by P. R. Bassett of Sperry Gyroscope Company, Inc Like many companies involved in rapid expansion, Mr. Bassett reported that the Sperry company, rather than expand haphazardly, sub-contracted 140,000 work hours, tried to keep a constant ratio of Sperry machine-hours to sub-contracted machine-hours, and proceed in an orderly fashion in getting the right machines and properly trained personnel for its own plants. Thus, the sub-contractors act as a cushion for the rapid acceleration in production.

At the annual Dinner and Honors Night of the Society's meeting, Charles F. Kettering, vice-president and director of General Motors Corporation, received the A.S.M.E. medal for his influence on automobile development. It is the highest award given by the society. The Melville medal was presented to Carl A. W Brandt for his achievements in railway mechanical engineering. Following the presentation of these medals, and other awards, William A. Hanley of Eli Lilly Company, Indianapolis, Ind., was inducted as new president of A.S.M.E.



Left—F. O. Hoagland, vice-president, Pratt & Whitney Division, Niles-Bement-Pond Company, and Warner Seeler, secretary, Warner & Swasey Company discuss matters at the Machine Shop Practice Division Meeting. Center—Sol Einstein, vice-president, Cincinnati Milling Machine Company, and A. M. Johnson, president, Barnes Drill Company watch the circus at the annual smoker. Right—Francis Trecker, sales engineer, and J. B. Armitage, engineering director, Kearney & Trecker Corporation, at the Machine Shop Practice Division Meeting

Rapid Expansion of Australian Machine Tool Manufacture Aided by Curtailed Imports

MELBOURNE—Australia's latest and most vital war industry, the manufacture of machine tools, is expanding rapidly. The Commonwealth Government has ordered tools valued at $6,500,000 from 28 engineering firms. Machines and tools are now being produced which only a year ago were thought beyond Australia's capacity.

When the war came, one Australian firm was manufacturing lathes, and two firms made power-presses. The commonwealth depended primarily on machines imported from the United Kingdom, Germany, and the U. S. The war cut off the German supplies, and it was not long before the United Kingdom and the U. S., experiencing a shortage of machine tools, restricted exports.

The Commonwealth Government decided to initiate an ambitious program of machine tool making. Thousands of tools, jigs, and gauges were ordered from Australian firms. One which did not exist a year ago now makes substitutes for 24 German cartridge machines, and with half a dozen other firms is producing a total of 700 of these machines.

Make Power Presses

Huge power-presses with capacities between 700 and 5,000 tons are being made. Also engine lathes capable of turing 30 foot lengths, 24 inch diameter gun lathes for turning, boring and riveting up to 20 feet in length, capstan turret lathes of various lengths, and shell lathes up to six inches in diameter. Sundry types of drilling, milling and shaping machines, large-capacity grinding machines, hacksaws, cold-saws and similar tools are also produced.

A factory now being equipped in Sidney for the manufacture of optical glass will be equipped entirely with Australian machinery. Other Empire countries have ordered Australian machines.

Establishment of an optical glass industry designed to supply service requirements has been entrusted to Australian Consolidated Industries Ltd., which will produce such precision instruments as artillery range-finders, anti-aircraft gun predictors, telescopes, and binoculars. Although optical glass has not been made in Australia previously, New South Wales has ample modern equipment for the manufacture of sheet glass and ornamental cut glass, and therefore has many experienced operators available. Previously spectacle lenses required in Australia were ground from imported optical glass. Firms doing this work will help in training additional craftsmen required.

Among other new industries shortly to be established will be one at Newcastle, New South Wales, making stainless steel, which will obviate shortage of surgical instruments. In Melbourne a factory will shortly be producing aviation spark-plugs, one of the few remaining airplane components still not manufactured in Australia. The factory's output will be usable by American types of planes, such as the Douglas, Lockheed Hudson, and Wirraway, now widely used in Australia.

Canada Rushes Plans For Larger Shipbuilding Program; Yards Active

MONTREAL — Canada is rushing plans for the development of shipbuilding on a much larger scale than heretofore. To insure "full speed ahead" the government has appointed a shipbuilding controller who will have unlimited powers in requisitioning materials, supplies, etc.

Present shipyards, some 16 on the coasts and 25 lesser yards working on smaller craft, have enough orders to keep busy for another year. To date 200 small war vessels, including boats used on inland waters, have been delivered. Recently contracts have been awarded for 10 diesel-driven minesweepers, 18 large cargo ships. Further orders for cargo ships are expected momentarily.

Arrangements have been made for the production of the following types of guns: .40mm Bofors anti-aircraft; 2.7 anti-aircraft; 25-pounder guns and carriages; Colt-Browning aircraft machine guns and tank machine guns; six and 2-pounder guns for tanks; four and 6-inch naval guns; and Lee Enfield rifles.

One of the biggest problems to be solved, if the government's schedule to produce $1,500,000,000 of munitions annually is to be adhered to, is that of labor. Since a concillation board jumped wages 17 per cent at the John Inglis Co., Bren gun makers, wage troubles have increased in all plants engaged in war work. Government schools for training young men for war industries are being expanded. At present 28,000 men are enrolled.

Subscriptions Held in Abeyance For Those in Military Training

NEW YORK — All subscribers to AMERICAN MACHINIST who are called to service in the armed forces of the U. S. will, on application, receive "letters of credit" if they desire to cancel their subscription of the magazine. The "letter of credit" will enable a subscriber to resume his subscription when his period of training is over.

SHIPS FOR ENGLAND

WASHINGTON—A deal, yet to be consummated, under which upward to 360 cargo ships will be built in the U. S. for British needs has been long delayed. However, in Britain's dilemma the U. S. sees an opportunity. The U. S. wants to build the ships and sail them in the service of England around Africa and on other "neutral" routes, but under the American flag. This would relieve England's far-flung shipping for concentration on trans-Atlantic service which is forbidden to U. S. ships because of the combat zone. This scheme would serve England just as well right now, but after the war the U. S. would have a set-up to muscle in on the Empire's trade. Predictions are that the U. S. will have its way. Nevertheless, the ships will be built. They will probably be in the 10,000- to 12,000-ton class. Further, a way may be found to release some of the C-type ships now being built by the Maritime Commission.

Air Conditioning Allows Control Of the Quality of Iron Produced

PITTSBURGH—Jones & Laughlin Steel Corp. has installed air-conditioning equipment capable of removing from seven to forty tons of water per day from the air blown into its No. 1 blast furnace at the Aliquippa Works. The installation will enable a closer control of the quality of iron produced.

This is the first modern air-conditioning unit to be installed in the North for conditioning air blown into a blast furnace. The equipment will be used to maintain a constant low moisture content in the air blast, eliminating the necessity of trying to out-guess the weather 24 hours in advance of charging the furnace. Ordinarily, wide fluctuations in humidity cause irregular blast furnace operation, which results in a smaller aggregate iron production.

Nazi Shortage of Skilled Labor Sees Use of Automatic Machinery

WASHINGTON — A shortage of skilled labor is forcing Germany's machinery industry to adopt automatic or semi-automatic machinery to an extent hitherto unknown in the Reich. The scarcity of raw material supplies and of foreign exchange has taught the industry to employ metal-saving construction methods wherever possible. This has led to an extensive use of welded instead of cast machinery parts, to substantial reductions in the dead weight of machinery.

INSIDE DETROIT

Auto sales records may continue to fall like tenpins throughout the 1941 model year. Used car inventories are high, but the turnover averages 30 days; shortages, however are forecast by Spring.

BY RUPERT LE GRAND, DETROIT EDITOR

DETROIT—Fat pay checks for auto workers and humming factories look like a sure thing for the entire winter. Local sources report that some plants will continue overtime work in December, and that tentative schedules for January and February are set so high that long hours are in prospect for those two months. Of course, not all producers are in such fortunate circumstances, but the five-day week with full crews may be accepted as the general situation of the industry during a period when seasonal influences have drastically cut production in the past.

Underlying these bright predictions is the word that parts plants have not been asked to pare schedules in the weeks ahead. Suppliers are ordinarily informed of their commitments for two to three months in advance. So far, the auto plants are still calling for all the parts that they can get. This condition may spring from either of two motives (1) anticipation of sustained heavy retail demand or (2) a fear of priorities in the spring. The first reason probably fits the case, because facilities are not available to store the flood of parts, nor is it desirable to over-supply dealers. The priority question is a bridge that hasn't been reached yet.

Buick Makes 1700 Cars Daily

Buick has attained a production rate of 1700 cars daily, and this rate will be unchanged through February, and possibly March. Schedules for the first quarter of 1941, if achieved, will top the 1940 period by around 25 per cent.

The operations of this G.M. division are more spectacular than most other producers, but it must be remembered that Buick was the bellwether of the industry during the 1940-model year. Before the present season started, the Flint concern expected a 10-15 per cent gain in production over the Oct.-Dec. period of 1939. Actually domestic demand is up 20 per cent. October retail deliveries reached 33,500 units, up 30 per cent, November sales will probably total 32,000, up 10 per cent, and December is expected to produce more than 31,000 sales, or 20 per cent ahead of last year.

A recovery of moderate proportions plus the superimposed national defense program are likely to bring about a retail sales situation whereby most, if not all, of the remaining months in the model year will establish new sales records. Reactions to events abroad are likely to prove only temporary, and decreased purchasing power through national-defense levies and higher living costs are not viewed as factors which will affect domestic demand during the balance of the 1941 run.

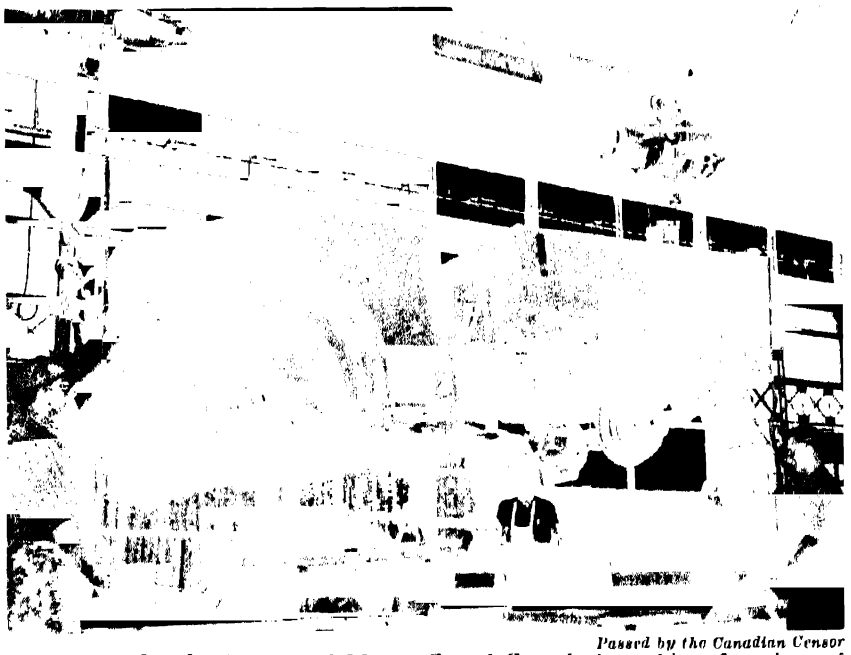
Used-car inventories are high, but the turnover averages 30 days, a very satisfactory figure at this time of year. Sales are keeping pace with trade-ins, a scarcity of used cars is forecast in the spring because national defense is creating new employment and adding working hours.

These opinions are shared by other producers, although they may not be quite so optimistic. Retail sales by the industry in November set a record, but the total was not quite equal to the October record because of holidays and bad weather. Large producers like Chevrolet can hardly be expected to make such spectacular gains as some of the independents and plants serving the medium-price field Yet it is production of such plant. as Chevrolet, Ford and Plymouth that is swelling monthly totals to near the 500,000 mark. Chevrolet produced its 300,000 current model on Nov. 27. Since the first of the 1941 units left the assembly line on Sept 23, Chevrolet chalked up three-tenths of a million cars in just 62 working days.

Pontiac worked six-day weeks in November. The last week of the month saw production of 8,376 cars, the highest weekly total since 1928. Dealer stocks are reaching the leveling off point, so it may not be

ARMY TRUCK ORDERS

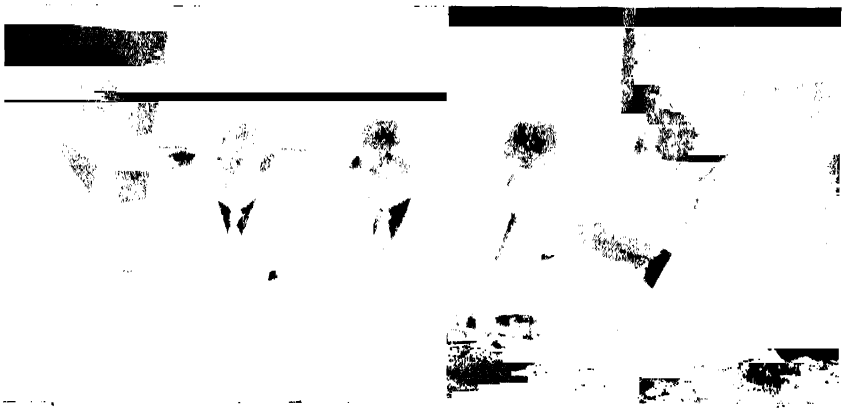
DETROIT — Government purchases of Army trucks are expected to take a bound upward in the near future. General Motors divisions are quite likely to get the lion's share. Corporation officials refulse to divulge information in advance of a public announcement from Washington, but it is known on good authority that Chevrolet's participation in the business will probably dwarf contracts already awarded. Yellow Truck & Coach is building an undisclosed number of trucks, about which the Army and G.M. have kept quiet. That division may also get further orders. It has already taken steps to double output on certain operations.



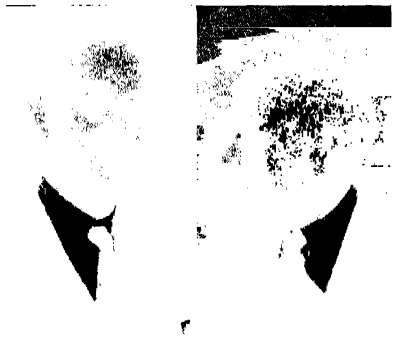
Passed by the Canadian Censor

On To England—*The Ford Motor Co. of Canada is making five sizes of all-purpose trucks for the British Army, including four-wheel drive types. Upon completion of satisfactory tests, running wheels and gear are removed and the truck is boxed for export*

Production for National Defense Discussed at Hartford A.S.T.E. Meeting



Tool Engineers Meet—*More than 200 members and guests attended the December 2 meeting of the Hartford Chapter of A.S.T.E. to hear Lt. Col. E. M. Ayer, Hartford Ordnance District, U. S. Army, and Clayton R. Burt, chairman, N.M.T.B.A. National Defense Committee, discuss production problems involved in the current defense program. Among the guests present were, left to right, Col. F. H. Payne, district chief, Hartford Ordnance District; Herbert H. Pease, president, New Britain Machine Co.; H. D. Tanner, vice-president, and Clayton R. Burt, president, Pratt & Whitney Division Niles-Bement-Pond Co.; and F. G. Hughes, president, New Departure Division, General Motors Corporation*



Guests—*Also present at the Hartford A.S.T.E. meeting on national defense were S. M. Stone, president, Colt's Patent Fire Arms Manufacturing Company, and H. M. Toppin, president, Jacobs Manufacturing Co. Arrangements for the meeting were made by Frederick L. Woodcock and Louis E. Eberts of Hartford*

necessary to continue overtime.

In the fine-car field, Cadillac had to go to the nine-hour day. Unshipped orders at the end of first twenty-day selling period of November stood at 11,774 units, an all-time high. The reason for overtime is apparent, when it is known that retail deliveries of 3,295 units set a new record for the period.

Hudson domestic shipments of 1941 models, for the first four months of the current selling season, already exceed one-half the volume of cars shipped in the entire 1940 season. In common with other makers, Hudson reports that West Coast cities such as Los Angeles, Portland and Seattle, are approximately 70 per cent ahead in sales as compared with last year, because of local national defense activities there.

Aircraft Engines

By this time it is expected that negotiations between Buick and the government will have been completed for manufacture of twin-row Pratt & Whitney engines at Flint. Company sources refuse to state which twin-row model will be built, how large a plant will be required, and how many engines are involved until an official announcement by the National Defense Commission. Suppliers, who logically might figure on equipment involved, have not been drawn into the picture so far.

Local sources are skeptical that Ford can get going on its Pratt & Whitney engine program until some time next fall because of the equipment-delivery situation. Packard has been buying machinery for installation in parts-suppliers' plants, since a number of items on the Rolls-Royce engine will be farmed out.

Midget "command reconnaissance 4-4" Army trucks designed to replace motorcycles and sidecars will start rolling from an assembly line at the Ford Motor Company in January. These trucks are designed to hide in brush, climb out of holes impossible to a tank, and may even be suitable for transportation in the cargo holds of Army planes.

Ford got an order for 1,500 trucks to cost $1,387,500; American Bantam an order for a similar quantity. It is understood that the Ford design is slightly lower in overall height, which is desirable for concealment purposes. Height to the cowl of the Ford truck is only 38 in., and the windshield folds down to 40 in. Length is 81 in., tread 47½ in. Despite the small size, the truck will carry a three-man crew, an all-angle machine gun to repel air attack and a sub-machine gun. If necessary, the vehicle might be used for hurry-up transport of troops, although it is not designed for attack purposes.

The truck is equipped with front and rear blackout lights. Maximum speed is 60 miles per hr., 40 per hr. cross-country. Four-wheel drive in combination with a six-speed transmission provides maximum maneuverability over all sorts of terrain. Six forward and two reverse speeds are supplied by means of the transmission, which is equipped with an auxiliary speed range. A lever is supplied to cut the front wheel drive in or out as needed. The Ford design weighs about a ton, will carry in excess of 1,000 lb., and is powered by the four-cylinder tractor engine, which has been modified to supply 42 hp.

Extend Export Licensing System; Forced by Faster Defense Pace

WASHINGTON—The increased pace of the National Defense program requires the extension of the export licensing system. The following items were placed on the export control basis as of Dec. 10:

All used or rebuilt machine tools of any description; pipe threading machines; metal cutting band saws; power-driven hack saws; keyseating and disc grinding machines; car wheel and locomotive wheel presses; gear burring; chamfering, and burnishing machines; crank planers; bench power presses; saw sharpening machines; filing and pipe bending machines; thread chaser grinders; burnishing machines; tool and cutter grinders, universal and plain hand feed; riveting and grinding machines, portable with flexible shaft; and centering machines.

Grinders, face milling cutter; arbor presses (hand, air, and hydraulic); drill, tap, and hob grinding machines; nibbling machines; lathe tool grinders; gear lapping and shaving machines; polishing machines; heat treating furnaces; foundry machines; twist and other drills; reamers; milling cutters; hobs; taps; dies; die heads, and shear knives.

McGRADY APPOINTED CONSULTANT

WASHINGTON—Edward F. McGrady, former Assistant Sec. of Labor, has been appointed special consultant on labor matters to Sec. Stimson. McGrady will act as government "trouble shooter" in industrial labor disputes.

WATCHING WASHINGTON

Vultee settlement still gives no indication of government policy toward strikes which impede munitions production. Administration favors large-scale expansion of war plants over priorities

By BLAINE STUBBLEFIELD

WASHINGTON—Settlement of the Vultee strike left largely unanswered the question of what an administration which prides itself on a pro-labor attitude is going to do about strikes impeding munitions production. One thing clear is that an outright showdown will be postponed as long as possible. The Vultee strikers were subjected to strong pressure, ranging from personal appeals by administration leaders to denunciation of the strike leaders as Communists by Attorney General Jackson. However, once the strike was over, the President tried with probable success to stall off legislative proposals to outlaw munitions strikes —though holding a threat in reserve by intimating that his views on the question are not unalterable.

The settlement also indicated that the strongest weapon for informal pressure is the group of comparatively conservative labor leaders who are under the influence of the President. The deciding element at Vultee, apparently, was the calling in of R. J. Thomas of the Auto Workers, who was the organizational superior of the strikers.

The Vultee strike helped to pose the issue. But the issue was there anyway; business and government and labor have been watching it, chary as one might eye a time bomb, for months. If the Vultee incident hadn't touched it off, some other incident would. Certainly no intelligent observer thought that organized labor voluntarily would suspend its rights under the Wagner law without a struggle. It is platitudinous to point out that the wage workers are going to shoulder up to the defense gravy though along with management.

An eventual showdown seems nearly inevitable. As the production tempo increases labor is acquiring scarcity value. A considerable element of labor, now largely under Lewis leadership, is not convinced that the country is virtually at war and is therefore not very amenable to appeals that production must under no circumstances be delayed. In aircraft, particularly, the CIO has announced its intention to unionize the now largely unorganized industry and bring wage levels up to those of the auto workers.

For the next few strikes, informal mediation will be relied on. There will be pressure on labor, as at Vultee, to accept arbitration clauses. There will certainly be pressure on unorganized employers to recognize unions and probably to grant moderate wage increases.

The Government is strapped solidly in the middle. New Deal policy is to help the working man to a better living. But it is also pledged to prevent spiraling prices and a war boom. Compromise is the one way open, both in executive and legislative action. But the Willkie wing in Congress, its strength already demonstrated, will lend a mighty drive to the Administration's cost control wing, which automatically opposes labor's interest.

One should remember too, that Mr Roosevelt himself is no longer the white hot crusader he once was. He doesn't have to be elected any more. His appointment to the Labor Board, of Dr Millis, a conciliator, is a good indicator of his turn of mind.

When the issue gets to Congress it will be a long bitter fight. Ultimate compromise may well be a variation of the Railway Labor Act for defense industries—a compulsory waiting period, government investigation and publication of results, with theoretical preservation of the right to strike afterwards.

MORE DEFENSE FUNDS NEEDED

WASHINGTON—A new and supplementary program on national defense, which will add billions to staggering sums already appropriated, is expected to be presented to Congress early in the January session. How much money will be asked isn't yet known. It may run up to $6,000,000,000; again it may be somewhat less. Just what activities the program will cover has not yet been determined. It is likely, however, to include money for a further ship construction project and for automotive manufacture of aircraft parts. Some experts in Washington are estimating that the total defense program will cost the country's taxpayers $35,000,000,000. A while back the figure quoted was $25,000,000,000. The truth is nobody knows what the final expense will be because nobody has any idea how long the armament program will last or what its ultimate scope will be.

Britain Gets Half

President Roosevelt's statement that we are already giving Britain our maximum of equipment means the 50-50 division, not volume. Even the half-and-half deal is only for today. The farther we swim across the river with England the less point there will be in turning back. If and as British success seems more likely, both the proportion and the volume of our aid will increase. It can very well turn out to equal or exceed our production in the World War.

The 50-50 division can be maintained and still be very misleading. For example, the half of our airplane production going to Britain is nearly all combat equipment, while the half we keep is mostly training planes. This kind of discrepancy can and does apply to other forms of munitions.

Expansion vs. Priorities

If the substantial expansion of steel capacity which the administration thinks will be announced within a week or two comes through it will soothe a problem which has agitated the administration in recent weeks and split the Defense Commission. Basic issue has been the alternative of expansion or priorities. The industry, fearful of excess capacity after the war, and questioning that demand will exceed present supply, felt that expansion could be avoided by rationing civil customers if the pinch came. It was supported in this view by Stettinius' raw materials division of the defense commission. In other sections of the defense commission, including Nelson's Priorities Board and Henderson's Price Division, it was felt that if inflation is to be avoided, the supply of civil commodities must be maintained. Government economists pointed to a tightness already being felt in the supply of heavy plates and structural shapes and to a level of steel production which is already crowding capacity with defense production barely underway.

The administration finally swung to the expansion side, and pressure was exerted on the industry. The President himself is supposed to have been called in, and reportedly a threat was made that big commercial steel customers would be encouraged to produce their own steel if the industry proved obdurate.

Bethlehem Steel Expands Its Plant; Others May Follow Suit to Speed National Defense

NEW YORK—Bethlehem Steel will expand its ingot capacity 850,000 tons at a cost of $18,000,000 The new facilities will be located at the Bethlehem, Lackawanna, Maryland and Steelton plants This comes on top of the action taken by Tennessee Coal, Iron & Railroad to increase its ingot facilities about 20 per cent It is highly probable that other major producers will follow suit

This steel expansion program is directly caused by the feeling on the part of members of the National Defense Advisory Commission that additional steel capacity is desirable to meet any possible needs for armament production New Dealers in particular, believe that the defense effort can be superimposed on the normal requirements of the country for non-defense goods and that as defense spending increases, the added purchasing power of workers will greatly stimulate sales and manufacture of such goods as radios refrigerators, washing machines and automobiles This development, according to administration economists may lead to a national yearly income of eighty-five to ninety million dollars Such expansion of activities would find present steel capacity unequal to the demand

For many weeks the steel industry has been running at 90 to 96 per cent of theoretical capacity This year it will turn out close to 70,000,000 tons of steel ingots, a total exceeding 1929 Much talk has been heard of the possible necessity for rationing steel through a priority system but thus far this has not been imperative Buyers accustomed through many depression years to getting steel deliveries almost overnight are now ordering two or three months in advance For many months it is believed that production has considerably exceeded consumption, indicating that users have been stocking steel against a rainy day

Not long ago Walter S Tower, president Iron & Steel Institute, issued a statement declaring that the maximum annual defense needs for armament purposes would not be over 8,000,000 tons and that no possibility of a shortage looms He pointed out that the industry's ingot capacity is rated at 83,000 000 net tons, which is 10 to 12 per cent below the real capacity, that margin being allowed for breakdowns and repairs of furnaces The industry can run close to rated capacity for sustained periods and go beyond for occasional periods In 1917, for example, it maintained full capacity for seven consecutive months

Mr. Tower emphasized that not all elements of steel demand ever rise to peaks simultaneously, and anyway any such peak is a passing phenomenon This is especially true of civilian demand Deficiencies, on the other hand, may occur in certain classes of products Alloy steels, for instance, have come to the front so fast, especially in relation to defense products, that a shortage of electric furnace melting capacity was anticipated by the industry some time ago and many companies have been installing new furnaces

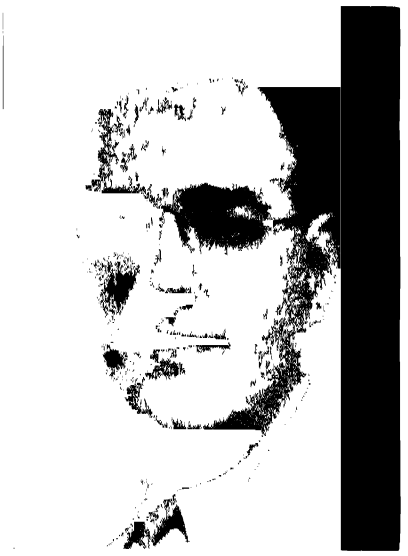
Canadians "Freeze" New Models To Aid Tool Makers in War Jobs

OTTAWA—The making of new models for automobiles, refrigerators, cooking equipment, radios, vacuum cleaners and typewriters is prohibited in Canada for the period of the war in order to enable toolmakers to concentrate upon the essential job of manufacturing jigs, dies and molds C G Howe minister of munitions and supplies, indicates that, "Existing models in current use in Canada will continue to be frozen No change will be permitted except for good and sufficient reason and then only under permit from the machine tool controller"

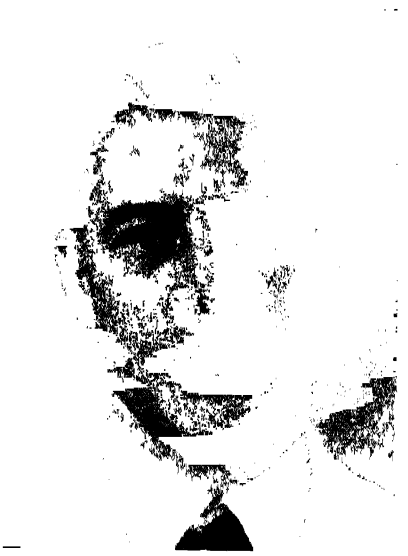
U. S. Government Contracts Awarded to Metal-Working Firms

(Does not include contracts under $100 000)

	Agent	Commodity	
Continental Motors Corp Detroit Mich	War	Automotive equipment	$204 662
American Brass Co Waterbury Conn	War	Small arms ammunition	180 264
Sperry Gyroscope Co Inc Brooklyn N Y	Navy	Automatic pilots	5 044 887
United Aircraft Corp Pratt & Whitney Aircraft Div East Hartford Conn	Navy	Airplane engines	57 856 179
Gisholt Machine Co Madison Wis	Navy	Turret lathes	107 337
Kearney & Trecker Corp Milwaukee Wis	Navy	Milling machines	320 373
Higgins Industries Inc New Orleans La	Navy	Boats	2 177 500
National Forge & Ordnance Co Irvine P	W	Forgings	133 633
Stewart-Warner Corp Chicago Ill	W	Artillery ammunition components	352 227
Budd Wheel Co Detroit Mich	W		405 760
Smith Bros Mfg Co Findlay Ohio	W		128 484
Southern States Equipment Co Birmingham Ala	W		440,534
Cleveland Container Co Philadelphia Pa	W		215 801
E I duPont de Nemours and Co Carneys Point N J	W		233 000
Carter Carburetor Corp St Louis Mo	W		2 9 34
Armstrong Cork Co Pittsburgh Pa	W		414 760
Briggs & Stratton Corp Milwaukee Wis	W		276 250
Blackhawk Mfg Co Milwaukee Wis	W	Jack assemblies	178 815
Mergenthaler Linotype Co Brooklyn N Y	W	Telescope mounts	1 194 710
Babcock & Wilcox Tube Co Beaver Falls Pa	W	Steel tubing	274 066
National Pneumatic Co Inc Rahway N J	W	Tubes	178 300
Standard Pressed Steel Co Jenkintown Pa	W	Cores	200 190
Midvale Co Philadelphia Pa	Navy	Forgings	5 121 125
Revere Copper & Brass Inc Baltimore Md	War	Cartridge cups	751 666
American Brass Co Waterbury Conn	War		1 035 850
Bendix Aviation Corp Eclipse Machine Division Elmira Heights N Y	War	Time fuses	10 218 000
American Locomotive Co Schenectady N Y	Navy	Turret rollers	144 978
Baldwin Locomotive Works Standard Steel Works Div Philadelphia Pa	Navy	Rollers	146 073
Cincinnati Milling Mach & Cincinnati Grinders Inc Cincinnati Ohio	Navy	Milling machines	319 431
Douglas Aircraft Co Inc Santa Monica Calif	War	Airplanes	161 549 794
Standard Steel Works N Kansas City Mo	War	Trailers	173 809
Bendix Aviation Corp Scintilla Magneto Div Sidney N Y	War	Distributor assem	231 503
Mergenthaler Linotype Co Brooklyn N Y	War	Quadrants	1 801 037
Gilbert & Barker Mfg Co W Springfield Mass	War	Telescopes	1 637 723
Sperry Gyroscope Co Inc Brooklyn N Y	War	Gun data computers	3 302 421
David White Co Milwaukee Wis	Navy	Sextants	136 734
Norris Stamping & Mfg Co Los Angeles Calif		Ammunition boxes	848 812
Commercial Shearing and Stamping Co Youngstown Ohio	War	Brackets	126 000
Flour City Ornamental Iron Co Minneapolis Minn	War	Bridge equipment	1 169 610
National Tube Co Washington D C	Navy	Bombs	206 139
Bridgeport Brass Co Bridgeport Conn	War	Cartridge cases	135 000
The Buda Company Harvey Ill	War	Boring machine	117 427
C H Gosiger Mach Co, Dayton Ohio	War	Lathes	218 911
Consolidated Steel Corp, Ltd Los Angeles Calif	Navy	Caissons	152 000
Continental Motors Corp Detroit Mich	War	Engine parts	294,662
Ford Motor Company Dearborn Mich	War	Engines	122,323 020
Remington Arms Co, Inc, Illion, N Y	War	Shotguns	165 253
The Midvale Co, Philadelphia, Pa	Navy	Forgings	670 000
Lansdowne Steel & Iron Co Morton, Pa	War	Forgings	539 760
American Brass Co, Waterbury, Conn	War	Brass strip	129 509
Ex-Cell-O Corp, Detroit, Mich	Navy	Pumps	170 673
Carlton Machine Tool Co, Cincinnati, Ohio	Navy	Drills	111 378
Axelson Mfg Co, Los Angeles, Calif	Navy	Lathes	279 907
Cleveland Tractor Co, Cleveland, Ohio	War	Tractors	185 747
International Harvester Co, Chicago, Ill	War	Cranes	374 593
International Harvester Co, Chicago, Ill	War	Tractors	631 171
Harbor Boat Bldg Co, Terminal Is, Calif	Navy	Boats	1 027 500
Curtiss-Wright Corp, St Louis Airplane Div, Robertson, Mo	War	Airplanes	62,278 067
Leece-Neville Co, Cleveland, Ohio	War	Generator assem	934 389
Bendix Aviation Corp, Eclipse Aviation Div, Bendix, N J	War	Generator assem	859,293



E E MOORE



J H MACK



DONALD A ROBISON

NAMES in the NEWS

Dr W D Coolidge and Stuart M Crocker have been appointed new General Electric vice presidents Dr Coolidge was director of the General Electric Research Laboratory in Schenectady and Mr Crocker served as manager of the company's air conditioning and commercial refrigeration department at Bloomfield N J

Bernard M Bickford has been appointed manager of the Evansville branch plant of Plymouth Division of Chrysler Corp

Paul L Gillan has recently joined the automotive and industrial engineering consultation staff of Aluminum Industries Inc Cincinnati

Paul Keller has been appointed Cleveland district sales manager for Copperweld Steel Co Warren Ohio

Arthur G Kimball president of Landers Frary & Clark New Britain Conn has been elected a governor of National Electrical Manufacturers Association

J H Mack formerly vice president of Chrysler Corp's Fargo Division has been appointed general service manager of the Corporation's Central Service Division replacing H J Nestle who has resigned

E E Moore has been elected vice president, industrial relations Carnegie-Illinois Steel Corp He succeeds D A Barrett who retired Dec 1 upon completion of 44 years of service with the organization Mr Moore was appointed general superintendent of South Works, Chicago in 1935 when Illinois Steel Co became a part of Carnegie-Illinois Steel Corp

Stewart W Munroe has been appointed general sales manager of the Chrysler Corp Mr Munroe joined forces with Walter P Chrysler in 1921 when Mr Chrysler had just been appointed chairman of the board at Maxwell

Donald A Robison formerly general sales manager has been named vice president of the Caterpillar Tractor Co with administrative direction of all selling and advertising activities Gail E Spain succeeds Mr Robison as general sales manager

Irvin A Ruder has been appointed manager of the Merchant Iron & Steel Div Iron & Steel Products Inc Chicago

Robert W Russell has been named special assistant to the general manager of the Hamilton Propeller Div Bridgeport Conn Mr Russell has been with the company since 1933 Harlan M Ellis has been appointed sales manager of the organization

Gaylord G Thompson formerly supervisor of the application and control of carbide tools at the Gisholt Machine Co Madison Wis has just been appointed tool engineer for the McKenna Metals Co Latrobe Pa

R A Travisano succeeds the late H T Smith as traffic manager of the Worthington Pump & Machinery Corp Mr Travisano has been connected with the Worthington Co since 1912

Claude K Swafford works manager of the Gisholt Machine Co Madison Wis has been elected to the board of directors H B Morey treasurer has been named vice president of the company and H J Homewood assistant secretary, succeeds Mr Morey as treasurer

L E Waldron and M S Raudebaugh have been appointed to the staff of the Rawlplug Co Inc New York Mr Waldron's headquarters will be at Charlotte N C while Mr Raudebaugh will maintain his office at Toledo

J A Williams formerly assistant to the vice president and general manager of the Curtiss Airplane Div Curtiss-Wright Corp Buffalo has been appointed manager of the organization's new aircraft factory now being built at Columbus Ohio Mr Williams joined the Curtiss organization in 1921

Joseph W Yowell formerly with Pan-American Airways has joined Manning Maxwell & Moore Inc Bridgeport Conn in charge of aircraft instrument sales

Raymond W Young formerly assistant chief engineer of Wright Aeronautical Corp Paterson N J has been appointed chief engineer, Arthur H Leak succeeds Mr Young as assistant chief engineer

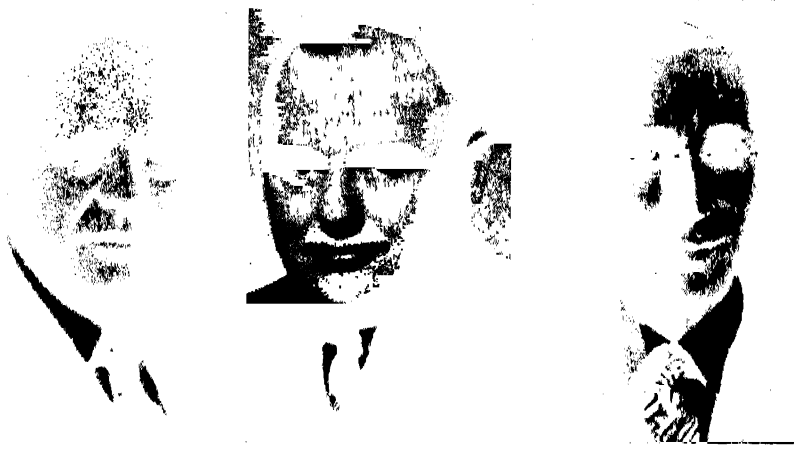
W C Williams Jr Frederick C Kroeger and Edward F Fisher have been elected vice presidents of General Motors Corp Mr Williams was also elected a member of the administration committee of the organization

PLANT EXPANSION

The Doehler Die Casting Co Batavia N Y will replace part of its magnesium and aluminum castings plant with two new buildings to cost approximately $200 000

American-Marietta Co Chicago has started construction at its Kan-

New Vice Presidents at General Motors Corp.



W. C. WILLIAMS, JR. EDWARD F. FISHER F. C. KROEGER

kakee, Ill., plant of two new buildings to handle the increasing demand for the company's products. The buildings are part of a $200,000 modernization and expansion program at Kankakee that was begun about a year ago.

Bendix Aviation Corp., South Bend, Ind., has awarded contracts for the design and construction of a $500,000 addition to its plant to be completed by Jan. 1. The expansion will have a total area of 154,000 sq.ft. and will be devoted entirely to the manufacture of carburetors.

The Houde Engineering Corp., Buffalo, has awarded a contract for construction of a $125,000 addition to its Buffalo plant. The organization is also planning construction of a $500,000 plant to produce munitions.

Sheffield Gage Corp., Dayton, Ohio, is erecting a new air conditioned gage manufacturing plant. The new unit will provide 32,000 sq.ft. of additional floor space, is scheduled to be in operation in approximately six months, will cost approximately $1,000,000.

Timken Roller Bearing Co., Canton, Ohio, will build a $40,000 addition to its plant at Columbus, Ohio. The expansion will increase the original plant by 15,000 sq.ft.

BUSINESS ITEMS

Anker-Holth Mfg. Co., Inc., Port Huron, Mich., has acquired the physical assets of the Airgrip Chuck Co., Detroit. Operations will be transferred to Port Huron at once and will be continued under the direction of Leo T. Neidow who started the air chuck business in 1917. The new division includes a complete line of air chucks, cylinders and valves.

American Car & Foundry Co. has netted a profit of $823,654 as a result of its operations in the past six months. This contrasts with a loss of $1,746,678 for the corresponding period in 1939.

Bendix Aviation Corp., a General Motors Corp. affiliate, has arranged the purchase of a large section of the former Atwater Kent property in Philadelphia. The unit, known as Plant No. 6, was purchased for an all-cash consideration of $1,000,000.

Eutectic Welding Alloys, Inc., New York, N. Y., was recently founded to manufacture and distribute the Castolin welding alloys.

A. C. Harvey Co., Allston, Mass., have been appointed jobbers of the line of Hobart "Multi-Range" arc welders, Troy, Ohio.

Snyder Tool & Engineering Co., Detroit, has broken ground for a 90x138 ft. addition to its present plant. The new structure will house two 15-ton cranes and will afford room for additional engineering facilities.

The Otis-Fenson Elevator Co., Ltd., Hamilton, Canada, has placed machinery requirements for a $9,000,000 plant to make complete Bofors anti-aircraft guns for England. The main structure will measure 300x1000 ft. A smaller one will be used for assembly and inspection. Over $7,000,000 will be spent on machine tools and fixtures. Between 8,000 and 10,000 jigs and fixtures will be required, many of which will be built in the U. S.

Sprage & Henwood, Inc., Scranton, Pa., and E. J. Longyear Co., Minneapolis, have been appointed sales agents for the newly introduced "Sinta-Set" diamond impregnated core-bits, produced by Carboloy Co., Inc., Detroit.

OBITUARIES

F. E. Bogardus, 54, ballistic engineer for the Remington Arms Co., Bridgeport, Conn., died recently at Bridgeport Hospital.

Arthur Brown, 61, superintendent of the Elmira Heights, N. Y., plant of the American Bridge Co., since March 1923, died recently following a two weeks illness. Mr. Brown was associated with the firm for 44 years.

Frank B. Hamerly, vice president of the Independent Pneumatic Tool Co., Chicago, died recently of a heart attack while inspecting the company's plant at Los Angeles.

Charles A. McCune, 61, research engineer and secretary of the Magnaflux Corp., New York, died recently in Atlantic City. Mr. McCune was a past president of the American Welding Society and of the International Acetylene Association, and a long-time coordinator of the activities of those societies with the activities of the A.S.M.

W. J. Austin, president of the Austin Co., Cleveland, Ohio, was killed at Chicago a week ago. He was a passenger on the airliner which crashed outside the landing field.

F. E. Saecker, 86, president of the Appleton Machine Co., Appleton, Wis., died recently at his home. Mr. Saecker had been president of the organization since it was founded in 1882. He was also an organizer of the Scolding Locks Corp., Appleton.

Frank Icke, 59, retired vice president and secretary of Fritzke & Icke, Inc., Milwaukee, makers of special machinery, died recently after a short illness. Last February Mr. Icke retired from the machinery firm.

MEETINGS

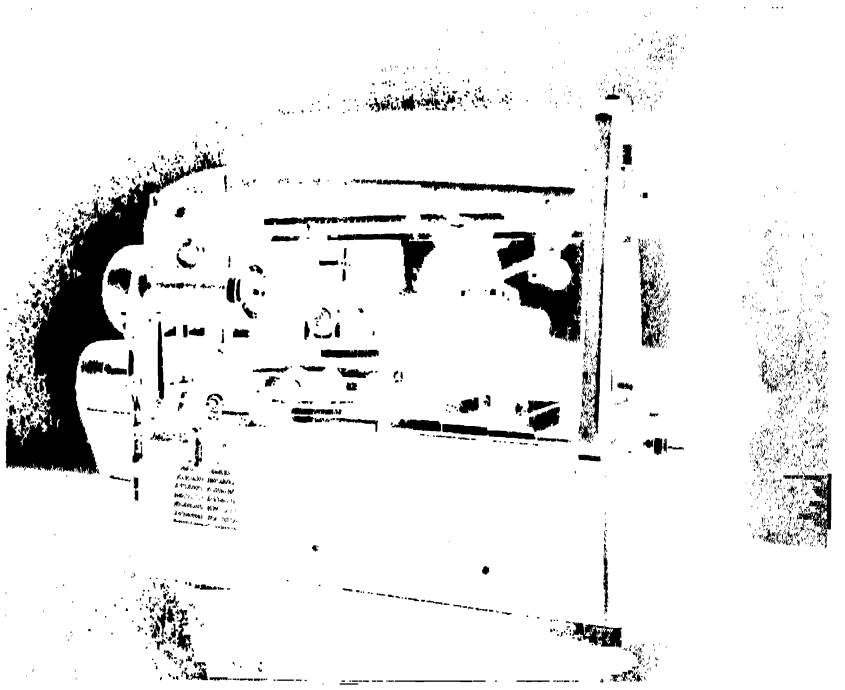
American Society of Mechanical Engineers. Semi-annual meeting. Kansas City, Mo., June 16–20, 1941.

Automotive Tool and Die Manufacturers Association. Annual meeting. Hotel Statler, Detroit, Mich., Jan. 21, 1941.

National Metal Trades Association. Annual meeting. Palmer House, Chicago, May 8-9, 1941.

Society of Automotive Engineers. Annual meeting, and engineering display. Book-Cadillac Hotel, Detroit, Mich., Jan. 6–10, 1941.

SHOP EQUIPMENT NEWS



Improved Barber-Colman Hobbing Machine Performs Wider Range of Operations

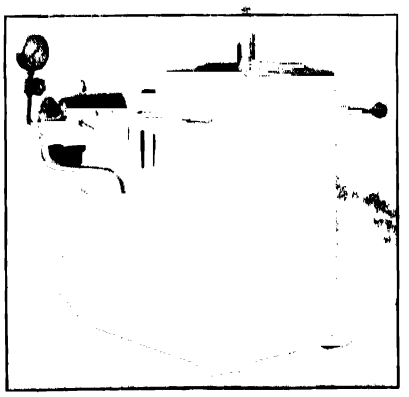
In many respects similar to the Type A hobbing machine which was originally designed primarily for hobbing taper splines on shafts, the Type T hobbing machine developed by Barber-Colman Co Rockford, Ill may also be used for standard hobbing of miscellaneous parts such as spur gears, spiral gears, straight splines, worms, worm wheels, and similar items

The main point of difference from the previous machine is in the hob swivel construction, which provides a means to traverse the hob not only longitudinally but also laterally Changes also include the moving back of the hob spindle shoulder to accommodate standard hobs up to 4 in in diameter and 4 in long and to permit a greater number of hob settings to be made

Operating and control mechanisms are somewhat different from those of the Type A machine There is an additional feed screw in the lower hob swivel slide to give the hob its longitudinal traverse A special micrometer dial on the work slide permits the operator to read the work spindle height above the hob spindle A similar dial on the main feed screw shows the distance between the spindle nose and the hob carriage unit A scale mounted on the overarm helps position a fixed stop for properly loading work A single large gear box contains all change gear trains This permits a complete change gear set-up to be completed in one position All controls are mounted on the left hand front of the machine convenient to the operator

30 Ton Pull Press Developed by Greenerd

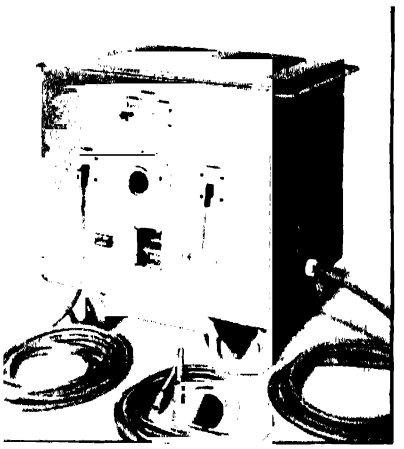
Greenerd Arbor Press Co P O Box No 415 Nashua N H has developed the No H 70 P 30-ton pull type press especially for those assembly jobs which require a pull rather than a push



Completely self-contained this machine has a 24-in diameter working table located 34 in above the floor The $2\frac{1}{16}$-in alloy steel hardened and ground ram is slotted to receive a drift pin. Ram travel is 17 in Rapid traverse speed is 138 in per min ; working speed at 15 to 30 tons pressure is 38 in per min Press is operated by a 10 hp 1200 r p m motor and starter for 220/440/550 volt, 2 or 3 phase, 50 or 60 cycle current

Allis-Chalmers Introduces "Weld-O-Tron Junior"

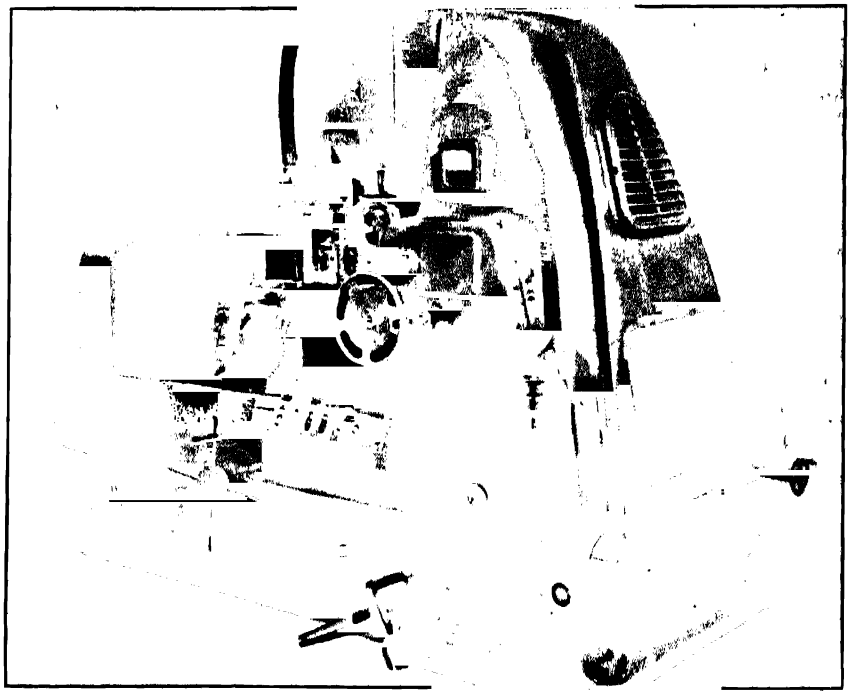
Allis-Chalmers Mfg Co Milwaukee, Wis , has added a "Junior' size to its line of Weld-O-Tron" low-current electronic arc welders for light gage metals Having a capacity of 5 to 40 amp it is especially designed for those plants already equipped with motor generator welders to handle currents as low as 35 to 40 amp



Like the larger units, this smaller size supplies currents as low as 5 amp and uses electrodes as small as " and " in in diameter It is especially suited to welding gages from 32 to 18 and is capable of handling material as thick as 14 gage

Welder consists essentially of a three-tube polyphase mercury vapor rectifier circuit eliminating all rotating parts Readily accessible controls and terminals are located on the front panel They are of the dead front type and consist of a simple two-way switch for changing polarity A handwheel with easily read dial provides fine adjustment of the welding current

Special Hanchett Rotary Surface Grinder Built to Finish Aircraft Engine Crankshafts



Hanchett Mfg. Co., Big Rapids, Mich., has developed a special adaptation of its No. 36 rotary surface grinder to grind aircraft engine crankshafts. The machine is fitted with a Hanchett-designed fixture to hold the crankshaft solidly so that the face where the counterweights are later attached can be ground square with the axis of the shaft to within 0.0004 in.

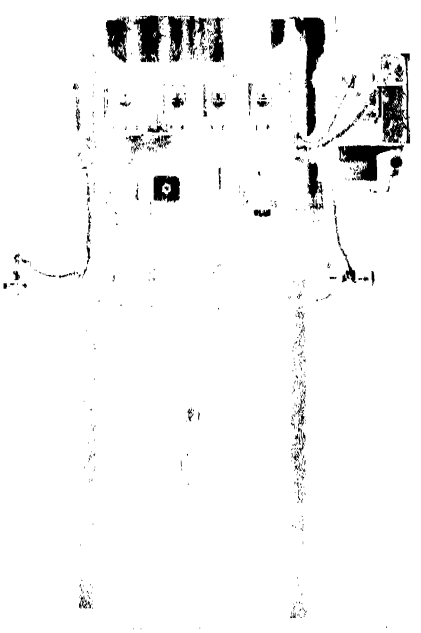
The grinder is equipped with an 18-in. cylinder wheel, which has a special diamond dresser to give the required radius to one corner. The wheel is driven by a 30-hp. 900-r.p.m. built-in motor. The rotary fixture table is mounted on the conventional carriage, its position under the grinding wheel controlled by a large handwheel at the front of the machine. This control permits accurate positioning of the crankshaft. Operated by a handwheel at the back of the machine is a micrometer screw stop which determines the correct grinding position for each succeeding crankshaft. There is a 175-gal. coolant tank in the bed of the machine, with a motor-driven pump. Entire grinder weighs approximately 19,000 lb., ready to operate.

Barrett Sterilizing Unit Cleans and Purifies Coolant

The combination sterilizer and sedimentator developed by Leon J. Barrett Co., Worcester, Mass., sterilizes and removes sediment from coolant in the same operation. The sterilizer is placed in the oil line between the extractor and the supply tank. Thus, located, it eliminates recently liberated germs that otherwise may immediately follow through the supply to a scratch on a man's hand or arm. The potency of infection is thus intercepted, forestalling expert medical treatment

The complete unit is a round tank with conical bottom. Heating under thermostatic control is by steam, electricity or gas. Coolant enters low and is distributed through the heated area, rising slowly during a 20-min. interval to an outlet near the top; it then drains by gravity to the supply tank. During the process the sediment settles out, accumulating in the funnel-like base.

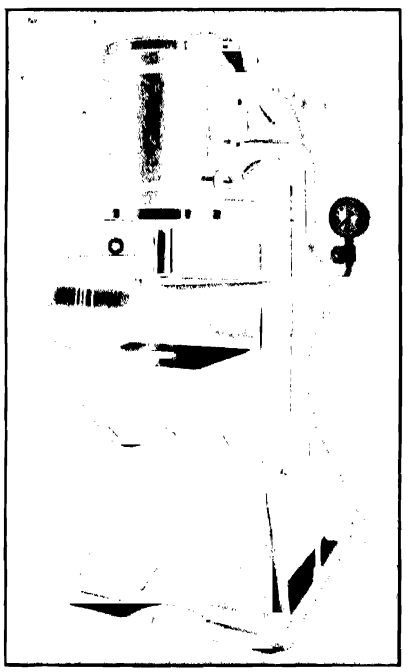
A special built-in wing scraper for unseating precipitated solids is actuated by a handwheel at the bottom. Clean-out is a simple matter of opening an outlet valve in the side near the bottom in the area swept by the scraper.



Greenerd Hydraulic Press Has 30-Ton Capacity

The No. H-70 hydraulic press offered by Greenerd Arbor Press Co., P. O. Box No. 415, Nashua, N. H., is self-contained, with pressure variable from 6 to 30 tons on the down stroke. Frame and cylinder are cast of semi-steel and the cylinder is honed to size.

Motor and pump are mounted on opposite sides of the main housing, being directly coupled. Oil sump is in the base. The 9-in. piston is



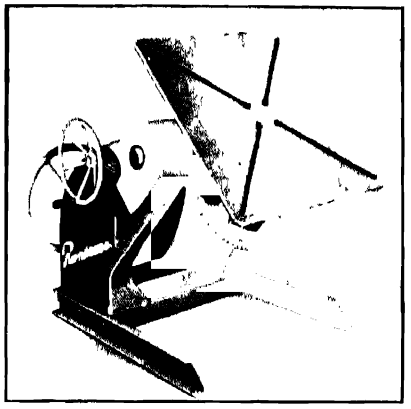
equipped with six cast iron rings. Ram is made of heat-treated alloy steel, hardened and ground, $2\frac{7}{16}$ in. in diameter. Working table is 18 in. wide, 15 in. deep, with a $3\frac{1}{2}$ in. hole central with the ram.

Rapid traverse speed of ram up to 15 tons pressure is at the rate of 138 in. per min., with instantaneous change-over to a working speed of 38 in. per min. within the range of 15 to 30 tons pressure.

The machine is designed to receive work up to 22 in. diameters; height over work table is 14 in. Stroke of ram is adjustable from 1 to 10 in. Press is equipped with a 10 hp., 1200 r.p.m. motor and starter for 220/440/550 volt, 2 or 3 phase, 50 or 60 cycle current.

Ransome Welding Positioner Handles 2500-Lb. Parts

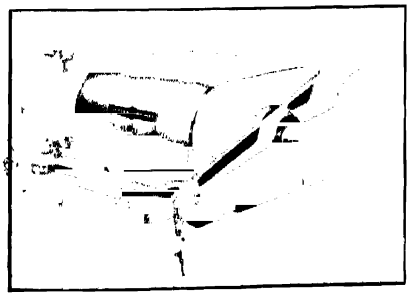
A positioner for pieces weighing up to 2500 lb. has been designed by Ransome Concrete Machinery Co., Dunellen, N. J., to facilitate handling of material in welding shops. The all-welded table top, with T-slots for easy clamping, revolves a full 360 deg. and tilts 135 deg. beyond horizontal. A worm and worm wheel arrangement makes the table self-locking when handling unbalanced loads. The machine is available with handwheels for manual operation or with tilting and revolving motors with remote control pushbuttons.

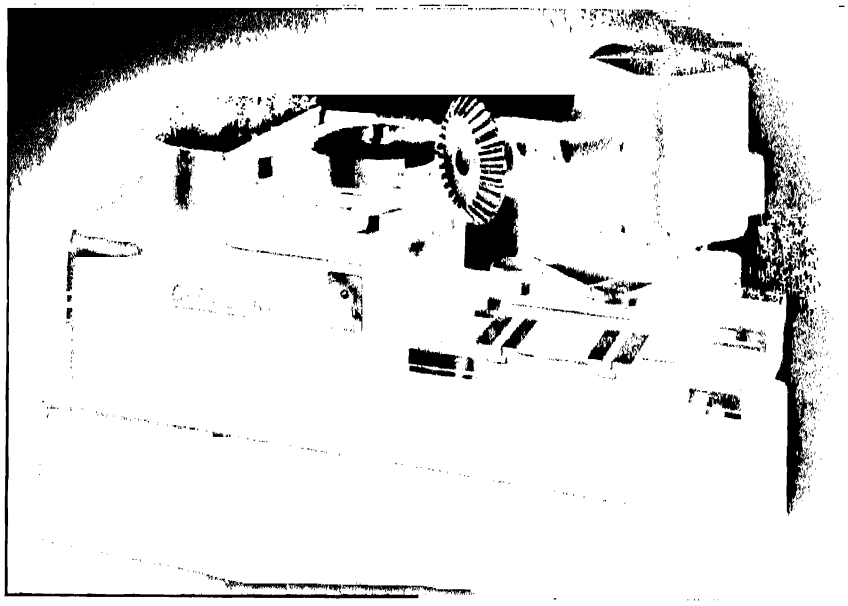


Crane Limit Stop Prevents Overtravel

Cutler-Hammer, Inc., 205 N. Twelfth St., Milwaukee, Wis., has developed a new type of main circuit crane safety limit stop to prevent overtravel of the crane hook when hoisting. This device operates by means of a counter-weighted lever and a suspended reset weight.

As the hook approaches its limit of travel the reset weight is raised, thus allowing the counter-weight to trip the switch. A quick make and break mechanism opens the normally closed power contacts to disconnect the motor from the line and closes another set of contacts to connect a resistor across the motor circuit and establish smooth dynamic braking. Taps are provided to adjust braking in accordance with service conditions. When the limit stop is in the tripped position, a by-pass circuit is established which permits backing out.





Gleason Straight Bevel Gear Rougher Rapidly Produces Correctly Tapered Tooth

A new method of rough-cutting straight bevel gears to produce rapidly a correctly tapered tooth slot is employed in the No. 7 straight bevel gear rougher developed by the Gleason Works, Rochester, N. Y. This machine is suitable for the roughing of straight bevel gears up to 14 in. pitch diameter and 6:1 ratio in large or medium quantities.

The outstanding advantage of this new type of machine is said to be close roughing both as to taper and tooth profile. Other important advantages are high rate of production and ease of set-up and operation. Fast cutting is possible because of rigid construction and the small number of moving parts. Use of a hydraulic chuck and hydraulic movement of the workhead also adds to speed and convenience of operation. A minimum of attention is required, as only the changing of the work and the pushing of the starting button are needed to operate the machine.

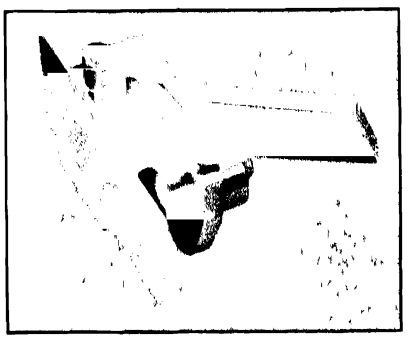
Proper taper and profile shape of the tooth slot are obtained by the combined effect of the cutter blade shape and a horizontal motion of the cutter spindle. A disk cutter which has blades extending radially from the cutter body is mounted to rotate in a horizontal plane. One cutter covers a limited range of gears and pinions

A single hydraulic control lever operates the workhead for changing blanks, including chucking, movement of the head, and clamping of the head. Indexing of the work spindle is controlled by change gears. Lubrication of the machine, except for the motors, is entirely automatic.

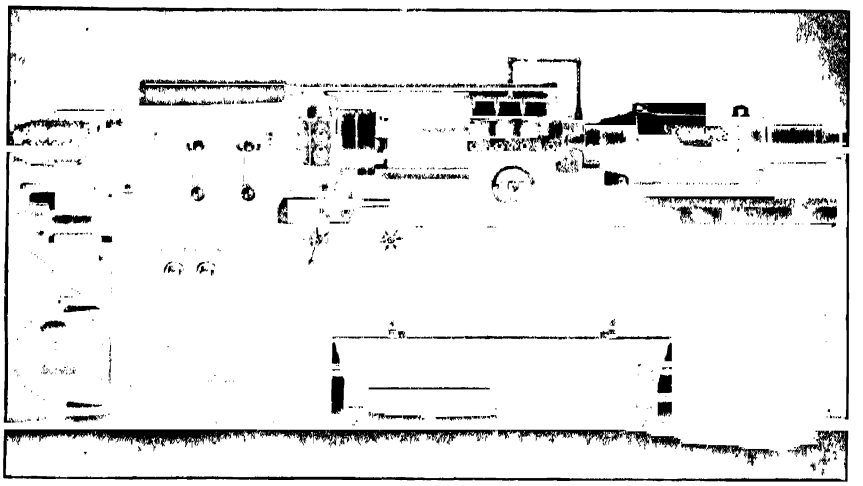
Specifications: Maximum pitch diameter (6:1 ratio), 14 in.; coarsest pitch, 3 d.p.; greatest face length, 2 in; extreme ratio (shafts at 90 deg.), 6:1; cutter diameter, 15 in.; net weight (approximate), 9,000 lb.

Anthony Cutting Off Tool Said to Eliminate Chatter

Chattering is claimed to be eliminated in the line of cutting off tools introduced by Anthony Cutting Off Tools, P. O. Box 1684, San Antonio, Texas. With these tools stock up to 10 in. in diameter can be easily and safely cut off, an operation made possible by the supported blade which gives strength and the safety slip which eliminates breakage. The diameter that can be cut is claimed to be limited only by the swing of the lathe. Four sizes are stocked, for diameters of 4, 6, 8 and 10 in. Still larger sizes are available on special order. It is claimed they will cut successfully diameters up to 16 in.



Sparks-Simplex "Hydro-Matic" Shell Lathe Designed for Sizes from 75 to 155 Mm.



Sparks-Simplex Machinery Corp., 49 Wall St., Norwalk, Conn., has developed the No. 101-A "Hydro-Matic" lathe especially for the manufacture of shell and small guns This lathe is said to be capable of all machining operations of all sizes if shell from 75 to 155 mm, with construction rigid and rugged enough to accommodate multiple tooling with the maximum cutting speeds permitted by carbide tools.

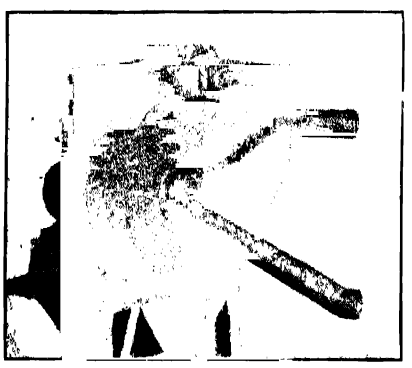
Principal features of the lathe include Timken bearings throughout, chain drive with arrangements for mounting motors of 10 to 50 hp, three-speed headstock, and hydraulic longitudinal feeds with automatic stop and rapid traverse Feeds from 0.008 to 0.040 in. are obtained by adjustment of a dial on the front of the machine. Power hydraulic cross feeds are supplied independently of the longitudinal feeds, eliminating necessity for any controlling cam feeds and simplifying manufacture and operation. Heavy-duty motor drive coolant pumps are supplied Large capacity chip pan can be easily cleaned from the back.

In cooperation with Cushman Chuck Co, a complete set of chucks for all shell sizes has been developed Quick chucking on inside chucking operations is accomplished by hydraulic cylinders connected through the spindle and operated through the main hydraulic supply line This is claimed to give sufficient inside pressures on the chuck jaws to hold all sizes, regardless of the cutter depth or number of tools operated

This lathe, with the same type of hydraulic feed, can be used for turning smaller anti-aircraft and tank guns by the use of extra long boring attachments and longer beds Standard lathe weighs about 7500 lb

Leiman Dust Collector Employs Double Suction

Double suction is a feature of the self-contained dust collector built by Leiman Bros, Inc., 101-EE-2 Christie St., Newark, N. J. This unit has been specially designed for drawing dust away from the top as well as the bottom of a buffing or grinding wheel The branched piping may also be adjusted so that the unit collects dust from two wheels at the same time. Collector is a complete unit, readily portable. It is available for one or two wheels up to 24 in in diameter



Francis Coating Machine Applies Draw Lubricant

Chas E Francis Co., Rushville, Ind., has developed a coating machine for applying draw compound to steel sheets preparatory to shaping or forming.

Machine includes two corrugated rubber rolls for coating sheets on both sides. A doctor or scraper roll is used in conjunction with each coating roll, not only to govern the thickness of spread but also to form a roll crotch to hold the compound. If so desired, the lower roll can be adapted to pick up its supply of mixture from a stationary or adjustable pan. Calibrated adjustments govern the spread and adjust opening between the rolls for thickness of metal.

Drive is by a direct-connected geared-head motor. Machine is furnished on a welded steel stand mounted on casters, to permit moving to different positions It can be had in any width, in regular or extra heavy construction, in bench or floor model, for single or double coating.



7,000-Lb. Load Handled By Clark "Utilitruc"

The "Utilitruc" lifting, carrying and tiering fork truck introduced by Clark Tructractor Div., Clark Equipment Co, Battle Creek, Mich., will handle loads as heavy as 7,000 lb and tier them in piles over 15 ft high This truck is said to be particularly efficient in car loading and unloading operations, in utilizing storage capacity to the full by high stacking and in serving production machines with materials and parts from storage. Gas-powered, it is capable of 24-hr. continuous operation

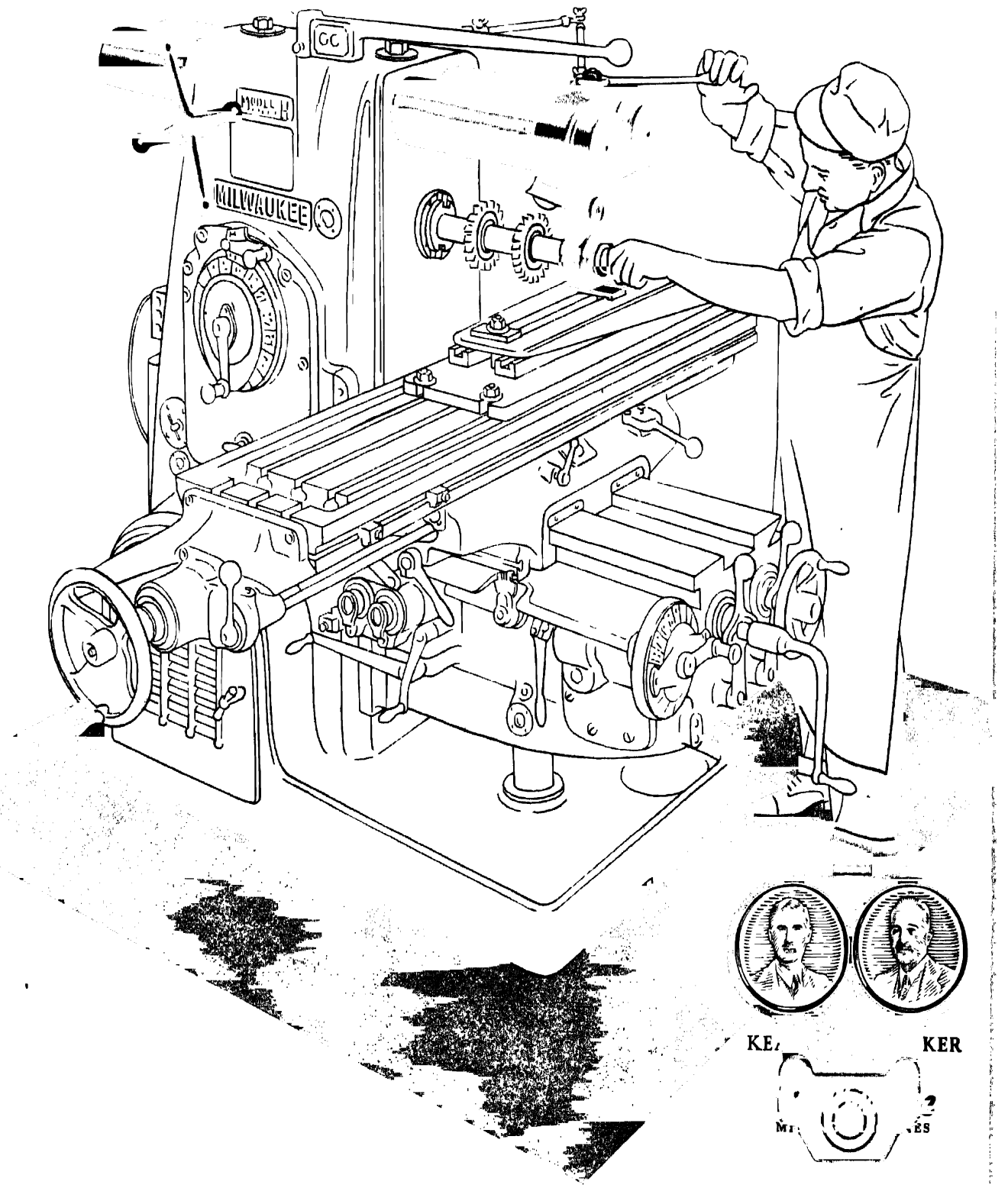
The truck is made in several models, including straight lift, tilting and telescopic tiering. Minimum height is 61½ in., enabling the truck to negotiate low doorways Minimum capacity is one ton. Heavy steel fingers, with chisel points, vary in length and are adjustable sidewise on the front plate. The operator inserts these fingers under any cleated or uncleated load, lifts the load clear of the floor, tilts it back 10 deg. in 1 sec. for safe riding, elevates it at the rate of 7 in. per sec., and tilts it forward 3 deg. in ½ sec. for easy tiering.

Machine is powered with a 6 cylinder heavy-duty tractor motor. It travels at speeds from 1 to 7 m.p.h.



In the advancement and development of milling machines, the overarm has played an important part. The construction of the Milwaukee double overarm increases rigidity and provides easy access to the arbor and cutters — a most important convenience to the operator.

KEARNEY & TRECKER CORPORATION • Milwaukee, Wis. U. S. A.

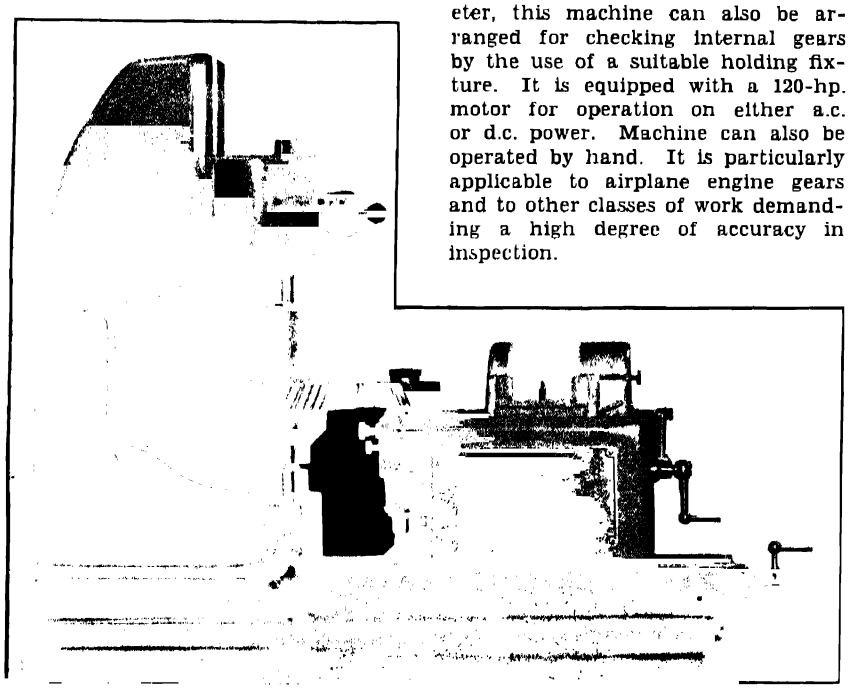


MILWAUKEE MILLING MACHINE

Fellows "Red Liner" Gear Checker Handles Gears on Adjustable Centers

The No. 20M "Red Liner" gear checking machine built by Fellows Gear Shaper Co., Springfield, Vt., operates on the same fundamental principle as the regular "Red Liner" machine, but is arranged to handle gears on centers which are adjustable. The lower center is adjustable to present the gear in the correct relationship to the master gear, while the upper center is adjustable for handling gears or arbors of different lengths.

Capable of checking both spur and helical gears up to 18 in. pitch diameter, this machine can also be arranged for checking internal gears by the use of a suitable holding fixture. It is equipped with a 120-hp. motor for operation on either a.c. or d.c. power. Machine can also be operated by hand. It is particularly applicable to airplane engine gears and to other classes of work demanding a high degree of accuracy in inspection.

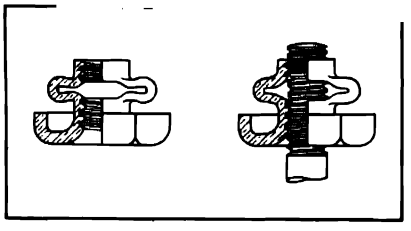


8-Mm. Roller Chain Developed by Diamond

Weighing almost exactly half as much (1½ oz. per ft.) as the smallest power transmission chain previously produced in the United States, No. 80 roller chain announced by Diamond Chain & Mfg. Co., Indianapolis, Ind., has been developed for dependable performance in services for which other roller chains are too heavy or bulky.

In spite of its minute dimensions, with rollers 0.197 in. in diameter and 0.125 in. in width, this chain averages 1100 lb. ultimate strength. It is practical for power transmission at extremely high speeds and for applications for which maximum compactness without sacrifice of enduring accuracy is essential—for positive driving of light-weight machinery, for timing mechanisms, for precision instruments and equipment, for facsimile models, etc.

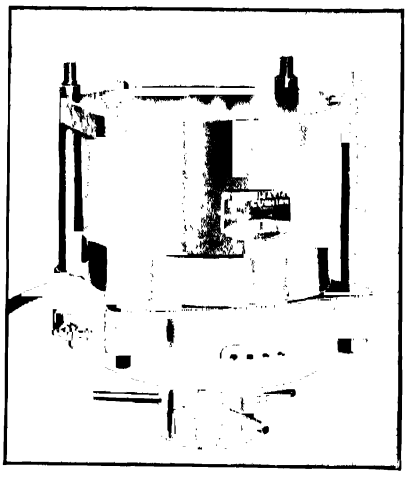




Boots Self-Locking Nut Manufactured by Scovill

A vibration-resisting, self-locking nut of the wing style has been announced by Scovill Mfg. Co., Waterbury, Conn., manufacturer and distributor for Boots Aircraft Nut Corp. When applied, the spring member of the nut expands to locking position, providing a constant tension.

In addition to the vibration-resisting feature, this nut presents all the advantages of the solid type, but is 10 to 50 per cent lighter and generally, size for size, cheaper. It is of all-metal, one-piece construction, and reduces labor and material costs of assembly. It is fabricated from steel and cadmium plated. Present sizes run from No. 6 through ¼ in.



Pneumatic Die Cushion Available in Seven Sizes

Dayton Rogers Mfg. Co., 2830 S. Thirteenth Ave., Minneapolis, Minn., has made available the Model D improved universal pneumatic die cushion, in seven sizes from 6 to 14 in., having capacities for deep drawing work from 2 to 6 in. for use with or without tank reservoirs.

Each cushion is supplied with a combination reducing regulating control valve and pressure gage. The die cushion may be mounted directly to the bottom side of the bolster plate, for all draw ring and pressure pad control operations, or spaced away from the bolster plate to any desired distance to allow blanks or slugs to pass through.

Correct height of the pin pressure pad is predetermined and maintained by the handwheel, thus compensating for bolster plate thickness variation, sharpening and grinding of dies, and changes in die design. Cylinder and piston are inverted on the section which serves as a pin pressure pad, making it possible to drop the pin pressure area to the maximum of the drawing stroke by releasing the air pressure and shutting off the supply so the pinplate stands out of the way for blanking and piercing operations.

Clemson Hacksaw Blade Claimed to Be Unbreakable

A tungsten-alloy hacksaw blade with the cutting qualities of all-hard tungsten blades, yet claimed to be so flexible that it cannot be broken in a frame, has been announced by Clemson Bros., Inc., Middletown, N. Y. This blade, known as the "Star" Unbreakable Special Flexible, is said to obtain its combination of opposing qualities through the use of a new tungsten alloy, heat-treated by a recently developed process.

The blade bears an all-over patented green metallic coating for protection, lubrication and identification, marking the first time a tungsten blade has been offered with an all-over finish in color.

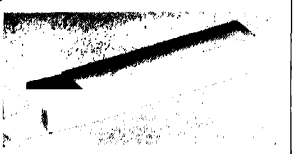
Announced Sept. 3rd—Industry rapidly ... Thousands already in Use!

NEW...CARBOLOY STANDARD TOOLS FOR "UNIVERSAL" SHOP USE ON 80% OF ALL TURNING, BORING, FACING JOBS!

Detroit, Sept. 3.—Mass production on a standardized line of Carboloy tools, designed to cover 80 per cent of all applications for cemented carbide tools, was announced by Carboloy Company, Inc., today.

The introduction of this simplified line of tools—comprising but five styles in three different grades—together with the economies resulting from mass production, has made it possible to price these complete tools well below comparable tools in the past, a typical new 'standard' tool, Style 4, now priced at only $1.85, comparing with tools previously costing $5.84 in lots of one. In quantities of 50 or more this typical tool now costs only $.90.

The program that has made this unprecedented step possible has been under development for the past three years. In the period from 1929 to 1937 prices of Carboloy cemented carbide



Style No. 1—Standard Tool
Available in 9 sizes

were progressively reduced four times as the result of economies resulting from increased consumption. About that time it became apparent that to widen the scope of useability of Carboloy tools required a complete revision of the principles under which such tools had been produced and sold up to then. What was needed was mass production of complete carbide tools on a scale never before attempted in this country.

Since 1937 extensive research work in the laboratory and in the field has been devoted to determining the fewest number of 'grades' of Carboloy and the simplest line of tools that would meet the vast majority of all carbide tool applications.

New $1,000,000 Plant Part of Program

Early in 1938 this development work had progressed to a point where Carboloy Company could proceed



Style No. 4—Standard Tool
Available in 9 sizes, left and right hand

with its next step—the expenditure of a million dollars on a new plant and equipment to expand and concentrate manufacturing activities. This plant, completed in the spring of 1939, was designed with a production capacity of ten times the amount of cemented carbide then consumed by industry, with provisions for expanding metal production to many times that amount.

Since that time, research and field experimental work has resulted in reducing the number of grades of Carboloy required for the vast majority of applications to only three —one new grade for steel cutting, and two for cast iron. Further, it was found that five styles of tools in each of these grades would cover 80 to 90 per cent of all turning, boring and facing applications.

The basic design of these tools is



Style No. 13—Standard Tool
Available in 5 sizes, left and right hand

such that several hundred variations can be rapidly ground in the tools by the user to meet special requirements. With the fast, simple grinding procedure developed during the past five years and now widely used by industry, such tool changes can be rapidly and economically accomplished. This rapid grinding procedure, plus the fact that the price of these new standard tools is comparable to that of many ordinary tools, brings to the field of Carboloy tool use a flexibility that permits broad 'universal' use of these tools within the average shop on short job-lot work as well as production runs.

The new standardized tools are carried in stock, ready for shipment, completely ground and ready for use. An extremely valuable feature is the incorporation of a ground-in chip breaker on all standard tools designed for the machining of steel, at no additional charge.

The new program, according to the announcement, is anticipated to produce a wider scale use of carbide tools, thereby reducing the cost of produc- of basic cemented carbides to that in spite of higher ost.

Carboloy Announces 6th Price R

Since the year when Carboloy tools were first introduced it has been ' e r Carboloy Co

For a number have realized tha reducing the l

- ✓ LOW PRICED! (Check against any other cutting tools)
- ✓ SIMPLIFIED ORDERING!
- ✓ SIMPLIFIED TOOL STOCKS!
- ✓ IMMEDIATE SHIPMENT!
- ✓ YOU GET THEM ALL GROUND READY FOR USE! (Steel cutting tools furnished with ground-in chip breaker)

Example of chip breaker ground in steel cutting tools.

Have You the Facts?

WRITE FOR CATALOG GT-125

CARBOLOY COMPANY, INC.

11149 E. 8 MILE BLVD., DETROIT, MICH.

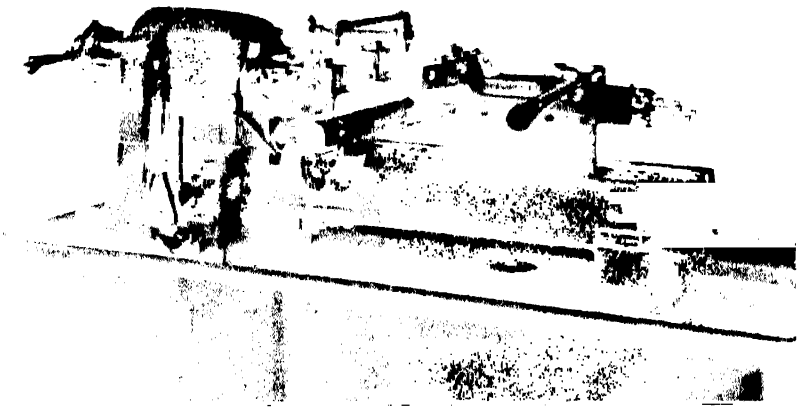
Chicago • Cleveland • Newark • Pittsburgh • Philadelphia • Worcester, Mass. • Los Angeles

Canadian Distributor: Canadian General Electric Company, Ltd., Toronto

CARBOLOY

REG. U.S. PAT. OFFICE

TANTALUM CARBIDES
TITANIUM CARBIDES
TUNGSTEN CARBIDES



Hardinge Precision Second Operation Machine Developed to Handle Hand Screw Machine Work

Hardinge Bros., Inc, Elmira, N. Y., has developed its high speed precision second operation machine to perform the same operations as its previous hand screw machines. This machine, designed for fast production with high precision, features an inclosed head with preloaded ball bearing spindle construction, electrical driving unit with multi-speed motor, eliminating all gears, clutches and pulleys, convenient lever speed control at the headstock, and all steel welded pedestal.

Machine bed is amply proportioned and rests on three spheres for perfect three-point suspension. Headstock employs bearings fully inclosed in an inner chamber. Rear of the spindle carries a double pulley for two V-belts from the driving unit These belts may be changed without removing the headstock spindle or bearings.

Automatic collet closer permits rapid opening and closing of the collets or step chucks while the spindle is at speed or stopped. Collets or chucks are easily opened by moving the conveniently located lever from left to right. Closer is adjustable so that any collet or step chuck tension may be applied on the part.

Rugged double tool cross slide has adjustable tool blocks and tool bit holders. Positive stops assure accurate cross slide forming. Standard circular form tool holders may be applied to the adjustable block in place of the tool blocks.

Tilted hexagon turret provides greater rigidity and tool clearance. Turret head is automatically indexed and locked into position by moving the operating lever to the extreme right. At the same time, the six independent turret stops are indexed, affording rapid and accurate turret operation.

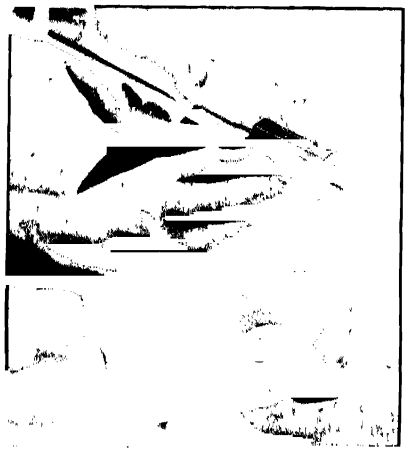
Two levers at the headstock control spindle speed through electrical motor controls. There are eight forward and eight reverse speeds ranging from 230 to 3900 r.p.m. Pedestal has a built-in coolant system.

Welded steel pedestal completely incloses the motor and driving unit. Motor is completely insulated from the pedestal by rubber cushions. A brake rapidly stops spindle. Machine has a 1-in. collet capacity, 6-in step chuck capacity and 9-in swing

Vibration Frequency Meter Has 500—20,000-Cycle Range

No larger than a slide rule, an 8-oz vibration frequency meter developed by Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., indicates frequencies from 500 to 20,000 cycles per minute. This compact device consists of a thin spring steel vibrator clamped at one end between a set of steel rollers. A knurled knob rotates the rollers, moving the reed in or out, changing its vibration frequency A sliding pointer on the reed indicates the frequency.

To use the meter, its head is held against the vibrating body and the adjusting knob rotated until the vibrator reed moves to and fro at maximum amplitude. If more than one frequency exists, there will be a point of maximum amplitude for each.



Raise-Lower Tramrail Cab Made Available by Cleveland

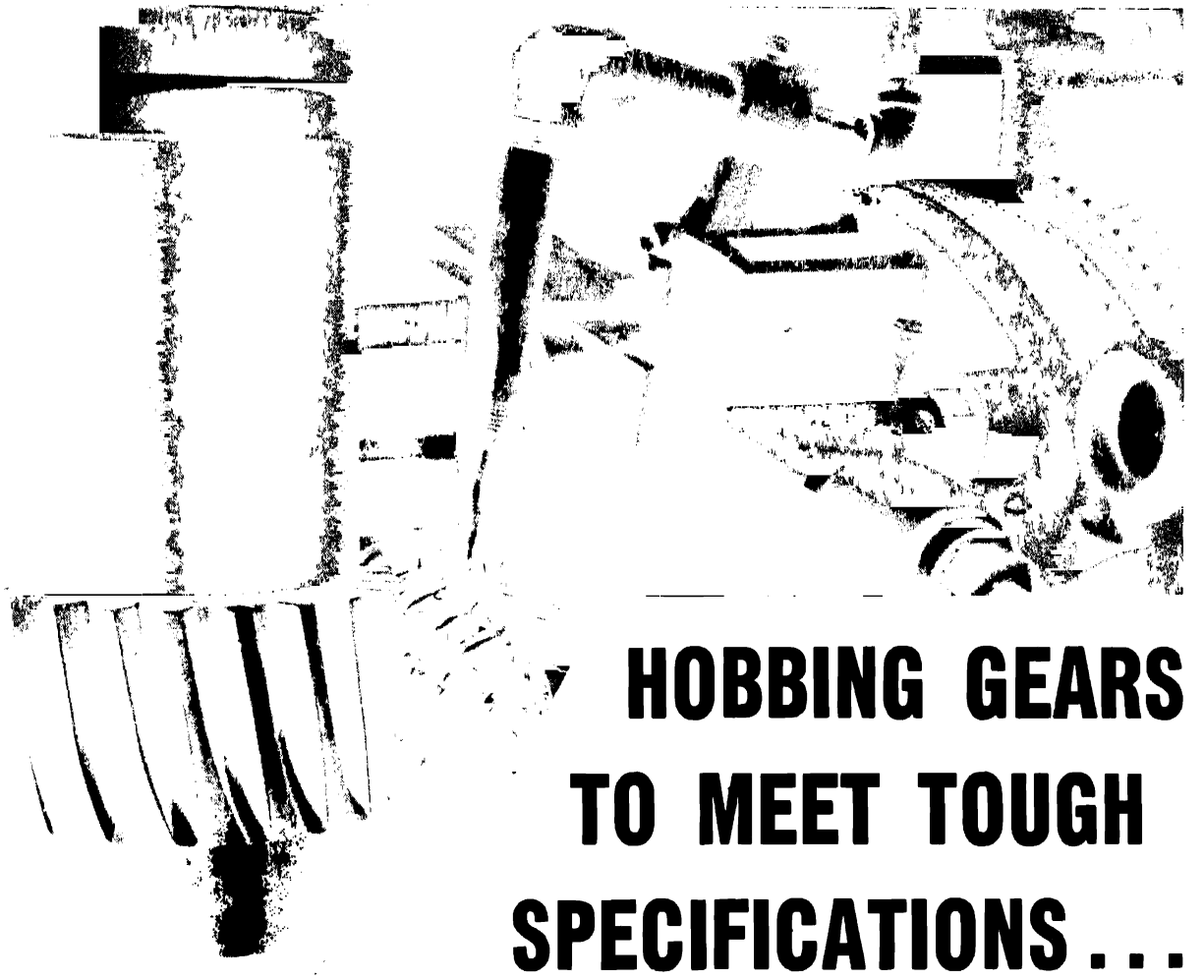
Cleveland Tramrail Div., Cleveland Crane & Engineering Co., Wickliffe, Ohio, has developed a type of tramrail carrier with raise-lower cab. Available in two general forms, this equipment provides for the raising and lowering of cab and load together, or for the cab and load to be raised and lowered independently.

With a raise-lower cab unit one operator may take care of all operations involved in moving materials with an electric cab-controlled overhead tramrail system: attaching load to crane hook, detaching, and operating the tramrail unit. If the materials are of such nature that a lifting fork is needed, one operator can also handle the entire job just as with a crane hook. Unit shown has a vertical travel of 40 ft. for both cab and hook. Equipment can be furnished for operation from much greater heights if desirable. Load hoist, cab hoist and carrier are all motorized and controlled from the cab.



100-Watt Fluorescent Tube Offered by Westinghouse

A 100-watt Mazda fluorescent lamp has been announced by the Westinghouse Lamp Div., Bloomfield, N. J. Five feet long and 2⅛ in. in diameter, this tube will be available in the 3500 F. white color, which has proved most popular and adaptable to the greatest number of uses. The 100-watt lamp adds a seventh size to the line of fluorescent lamps now manufactured by Westinghouse. Allowing higher mounting heights, the lamp will reduce the size and number of fixtures necessary to supply a given amount of light. It has a rated initial output of 4,400 lumens and a rated life of 2,000 hours.



HOBBING GEARS TO MEET TOUGH SPECIFICATIONS . . .

HOBBING gears of extreme hardness (325—350 Brinell) as used in oil well pumping reducers—for particularly arduous duty—was the problem of a Chicago manufacturer. In cutting and maintaining this unusual hardness and maintaining high accuracy, Cities Service oils were used as the cutting lubricant.

No doubt you have one or two like problems in your shop. Why not find out what our lubrication engineers can do for you in your own shop with the right metal cutting lubricant? Just write us to have a lubrication engineer call.

Copies of our booklet on "Metal Cutting Lubrication" are available to users of metal cutting lubricants. Write for your copy today, before the supply is exhausted.

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Cutting Oils

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Please send me information concerning your Lubrication Engineers' Service [ ]

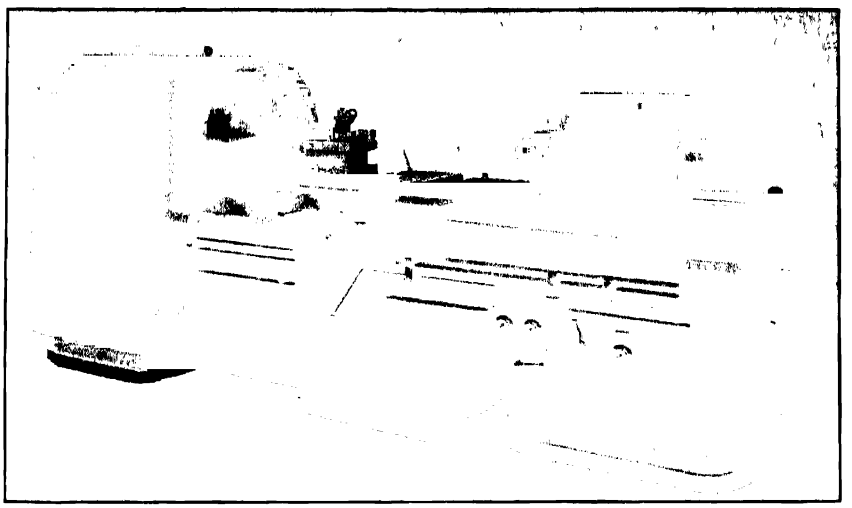
Please send me booklet on Metal Cutting Lubrication [ ]

Name *Title*

Business Address

Firm Name

City *State*



Morey Heavy Duty Hydraulic Lathe Is Especially Adapted to Shell Machining

Featuring directional fingertip control, the 27-in. heavy duty hydraulic manufacturing lathe offered by Morey Machinery Co., 410 Broome St., New York, N. Y., is especially adapted to the machining of such munitions items as shell. Designed for single purpose operations, this lathe is built to utilize the maximum speeds and feeds which present day cutting materials permit.

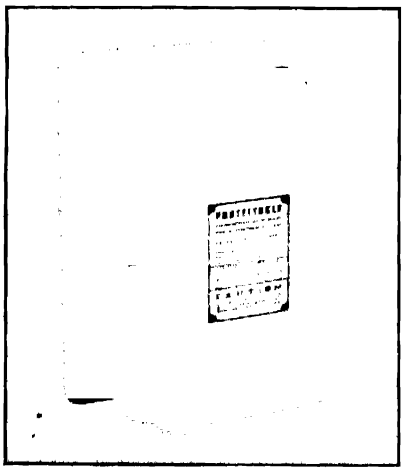
Machine is assembled from a number of basic units so that a combination of them will produce a complete line of equipment for machining the shell from the rough forging, ready for thread milling. The lathe is also built with a hexagon turret with individual stops, mounted on a separate saddle.

Spindle is mounted on Timken bearings, front and rear. Diameter of spindle bore is 6 in. Main drive herringbone gear is 22 in. in diameter, driven through spiral pickoff gears, a twin disk clutch and multiple V-belt from the motor. All driving mechanism is inclosed in the headstock and is controlled at the carriage. Hydraulic feeds are controlled from the carriage apron, so that the operator's position remains with the cutting tools. Controls are interlocked so that when the clutch lever is thrown out to stop the spindle, the feeding mechanism stops automatically.

Carriage can be supplied in five combinations to cut a great variety of work. Tailstock requires no manual effort for operation, and is directionally controlled by a single lever, operating a complete hydraulic circuit.

"Protectoglo" Relay System Guards Against Flame Failure

What is claimed to be a safe and reliable method of protection against failure of oil, powdered coal, and other luminous gas flames is announced by the Brown Instrument Co. Div., Minneapolis-Honeywell Regulator Co., Philadelphia, Pa. Known as the "Protectoglo Photo-Electrode" system, this method utilizes a photo-electric principle whereby the necessity of placing a metallic electrode in the high temperature is avoided, but which retains the quick response characteristic of thermionic systems.

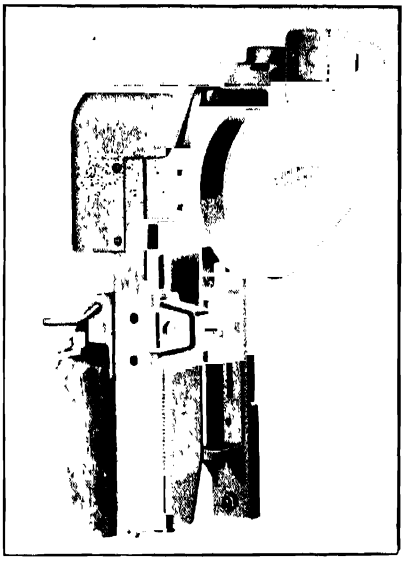


Operation of the system is similar to the "Flame-Electrode" system. The principle difference lies in its method of flame detection. Instead of using a metallic electrode, it detects the presence of a flame by the light emitted when a burner is in normal operation. Light from the flame is directed upon a photo-cell. This results in a small flow of current through the cell which is amplified by a vacuum tube circuit until of sufficient magnitude to close a relay. Through the relay contacts, the main fuel valve is energized.

Divine Composition Applicator Saves Time and Compounds

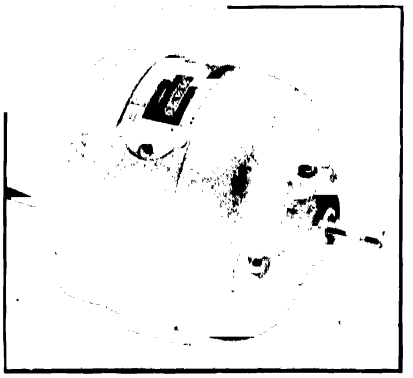
The Model AK-4 automatic composition applicator introduced by Divine Bros. Co., Utica, N. Y., is claimed to save time and conserve buffing compounds by automatically applying compounds to the face of buffing wheels, in an exact amount at the proper time. This applicator can be used in conjunction with lathes for hand buffing, and is especially suitable for all types of automatic and semi-automatic buffing machines.

The device is easily moved from one machine to another, the applicator being a self-contained unit. It can be mounted in any position, either horizontal or vertical.



Improved Dumore Motors Have Self-Aligning Bearings

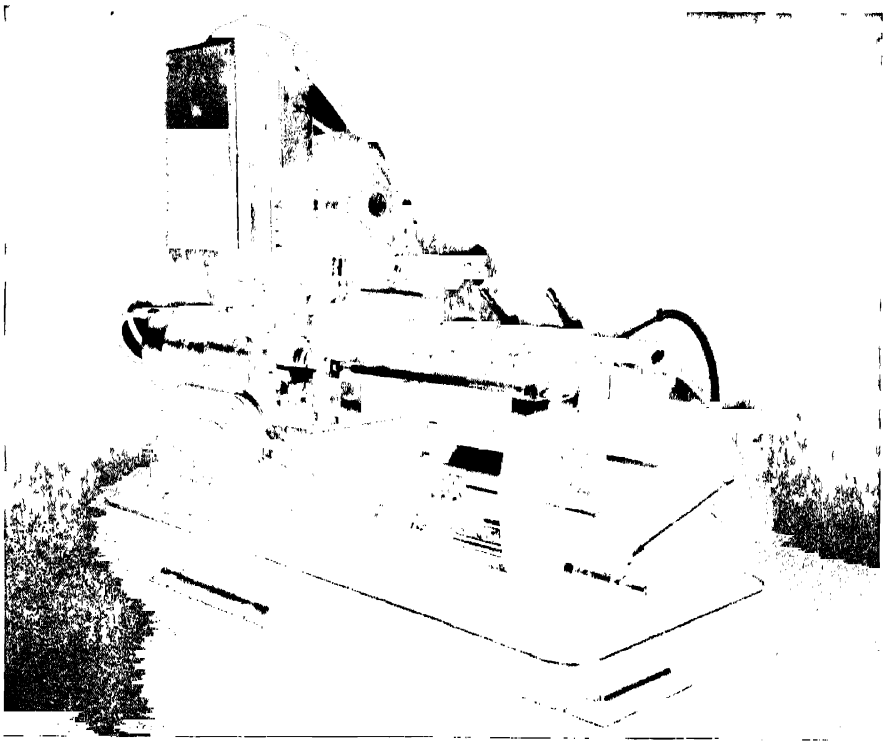
Dumore Co., Racine, Wis., has improved its types A and A3 fractional-horsepower motors by the addition of self-aligning bearings and incorporation of slight changes to improve appearance. The new motors, identified as types AA and A3A, are rugged, general-purpose power units suitable for either a.c. or d.c. operation. Power outputs of the two motors, respectively, are 1/30 and 1/15 hp. when operating on alternating current and 1/20 and 1/10 hp. on direct current.



THE MONTH

PREPARED BY THE SENECA FALLS MACHINE CO. "THE Lo-swing PEOPLE" SENECA FALLS, NEW YORK

NEW MODEL R Lo-swing ON AERO MOTOR CYLINDERS



Problem: To rough turn O D, square, and face both ends of aero motor cylinder forging, approximately 8″ O D by 11¼″ long, with a 5″ forged hole.

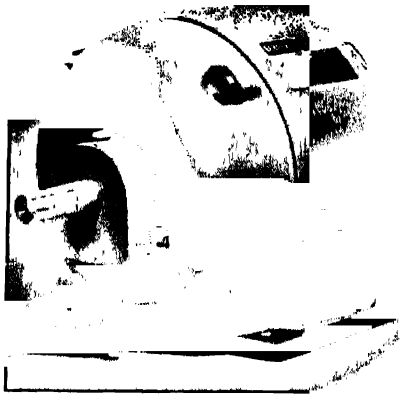
Solution: The new Model R-14 Lo-swing was selected for this job because of its capacity, power and the rigid tool support inherent in Lo-swing design. The accompanying illustrations clearly show the tooling setup for this job. Four turning tools are mounted on the main carriage and five squaring tools on the Back Attachment. Both turning and squaring are performed simultaneously. About 35 pounds of metal are removed in these operations.

Among the interesting features of this setup is the arbor with six expanding jaws which holds and drives the work. This arbor is fixed to the spindle nose and its outer end supported by the tailstock during the turning operation. In order to expedite loading and unloading of the work without excessive overhang of the tailstock spindle, the entire tailstock is moved longitudinally on the way by an electric motor drive. After the rough work is placed on the arbor, the motor drive moves the tailstock to the forward position in which it is clamped securely to the way. An air cylinder then moves the tailstock quill forward a short distance to support the arbor.

The new Model R-14 Lo-swing illustrated is equipped with the fully mechanical Seneca Falls Quick Change-over Mechanism which makes it possible to change the stroke by merely setting a graduated dial. Easy access to this mechanism is provided through the sliding door on the carriage front.







G.E. "Tri-Clad" Motor Embodies Many Improvements

As a result of a survey of changing requirements of its industrial customers, General Electric Co., Schenectady, N Y., has developed an entire line of completely new polyphase induction motors, in integral horsepower sizes, to conform with new industrial trends, processes, and practices. Known as the "Tri-Clad" motor and representing one of the most extensive product changes in the history of the company, it features modern streamlined appearance, more complete protection—through the use of a cast-iron frame—than heretofore available except in specially inclosed machines, major advances in the insulation of current-carrying parts, and improved bearing design and lubricating arrangements At the same time, it incorporates the cast-aluminum rotor, pressure-relief system of greasing for ball bearings, and other proven features.

In place of the conventional open frame, this motor uses a cast-iron box type frame. End shields match the frame and are inclosed above the center line, minimizing contact of vital motor parts with foreign material. "Formex" insulation, dust-tight bearings, and Glyptal in priming and finishing paints armor it against attack of harmful agents. New-type sleeve bearings provide greater life for angle mountings.

Houghton Rust Preventives Utilize New Base Material

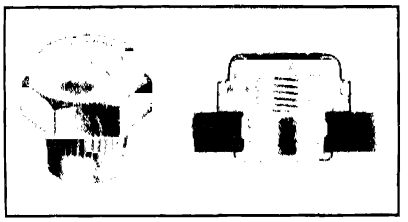
A series of rust preventives, including liquid rust-inhibiting non-drying products, built from a newly developed base has been announced by E F. Houghton & Co., 240 W. Somerset St., Philadelphia, Pa. This series also includes grease-type (non-drying) products; drying, hard-film products, semi-drying (waxy film) and soluble rust preventives. The new basic material provides a non-crystalline homogeneous film, with a high degree of cohesion and adhesion to metals. It makes a "non-tacky" unbroken film.

Knurled-Shank Clinch Nut Aids in Sheet Metal Work

For fastening sheet-metal assemblies in which the parts must be readily removed and returned to position, a clinch type of self-locking nut with knurled shank is offered by Elastic Stop Nut Corp., 2332 Vauxhall Rd, Union, N. J.

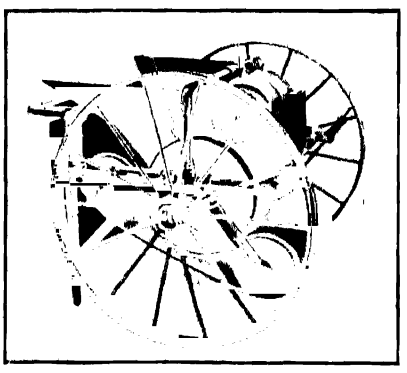
To install the nut, a hole is drilled in the structure and the shank pressed into the hole. The mouth of the shank is then spread against the back of the structure to effect a clinching hold. The knurling engages the drilled surface and assists in eliminating any turning of the nut.

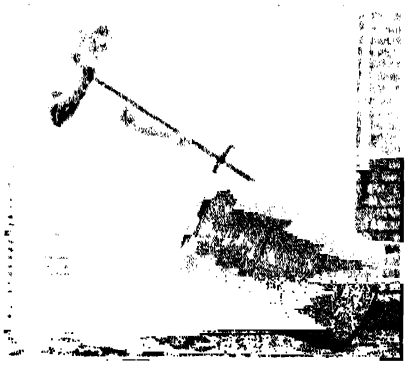
The nut head is fitted with a vulcanized fiber collar which, being unthreaded, resists the entrance of the screw, thus automatically taking up all thread play and bringing the load-carrying thread faces of nut and screw into tight contact. As the screw thread forces its way through the collar, pressure is maintained and increased to such a degree that the screw cannot work loose. Because of the resilient character of the fiber collar, the screw may be removed and replaced repeatedly without loss of locking action.



Materials Loader and Piler Improved by Stephens-Adamson

Three improvements have been made in the loader and piler manufactured by Stephens-Adamson Mfg. Co, Aurora, Ill. First, all loaders are equipped with "Sealmaster" permanently sealed, self-aligning, prelubricated ball bearings for minimum maintenance and maximum power savings Second, a simplified belt-alignment adjuster works from only one twist with an ordinary wrench. Third, the loader frame has been redesigned for greater strength and improved appearance



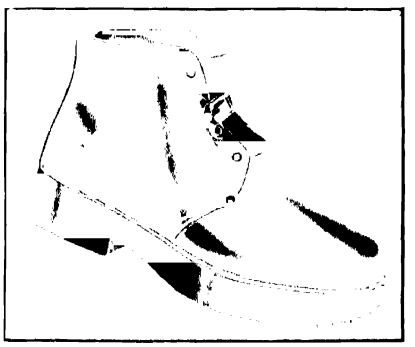


Lewis-Shepard Drum Tipper Fits All Types of Barrels

Lewis-Shepard Sales Corp, 245 Walnut St, Watertown, Mass., has developed a new device for safer handling of barrels and drums This simple tipper consists of a strong handle with a pronged adjustable collar. This collar allows the tipper to fit all types of drums and large or small-bilged barrels Its job is to make quick and easy the job of tipping barrels from a horizontal to vertical position or the reverse. Long handle increases the leverage so that less effort is required to handle barrels or drums than when attempted in the ordinary manner

Wood Soled Safety Shoes Provide Greater Comfort

Increased comfort is provided in the improved Davenport safety shoe offered by F J Stahmer Shoe Co, Davenport, Iowa Specially designed for use where ordinary leather soled safety shoes do not offer sufficient

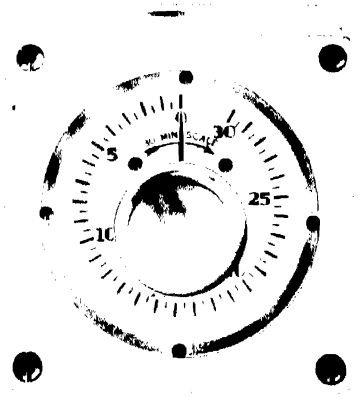


protection, this shoe has vamps and uppers made of pliable, tough, oiled grain leather. Sole leather is used for counters. Special felt insoles are thicker for added comfort. Wood soles of select close-grained maple have the correct rock from heel to toe for greater ease of walking. Thickness of sole at ball of the foot is 1 in. Heel thickness is $1\frac{1}{4}$ in.

Safety toes in these shoes are available in composition or steel. Composition toe resists pressure up to 600 lb. Steel toe resists pressure up to 4,000 lb.

Cramer Interval Timer Is Dust, Moisture Proof

The Model D2 interval timer has been designed by R. W. Cramer Co., Centerbrook, Conn., especially for control of industrial equipment which may be subjected to excessive moisture and dust conditions. A standard self-starting synchronous motor driven interval timer is sealed in a cast aluminum housing arranged for conduit connection and provided with a full vision window and external setting knob. Twelve different scales are available, ranging from

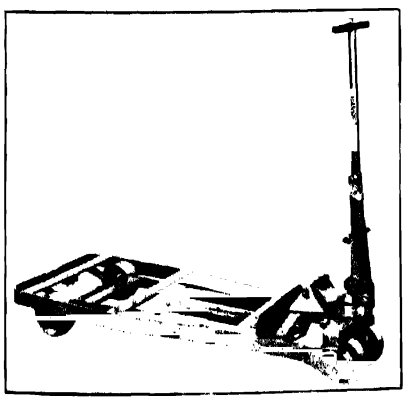


one revolution in 15 seconds to one revolution in 24 hours. Three-inch dials with large characters provide good vision and facilitate accurate setting.

Multiple Stroke Lift Truck Has 2,500 Lb. Capacity

Known as the "Light Boy," the Model GX lift truck introduced by Barrett-Cravens Co., 3255 W. 30th St., Chicago, Ill., has a capacity of 2,500 lb. It has a lift of 3 in., accomplished with either four full or thirteen short strokes. Ball bearing wheels are standard equipment. Front wheels are wide-spread for stability.

This model is made in sizes ranging from 30 to 144 in. long in multiples of 6 in., with either 6, 7, 9 or 11 in. diameter wheels; and in widths of 18 and 24 in.



(advertisement)

Manufacturers Look to Steel Warehouses for Quick Defense Requirements

Many leading manufacturers are relying on nearby steel-service plants for prompt, stock shipment of steel to meet the current surge of business prompted by Washington's defense program.

Probably the leading exponent of "Immediate Steel" is Ryerson with a network of ten strategically-located plants each of which has large and complete stocks of steel and allied products. In addition, each plant is equipped with complete forming and cutting facilities so steel can be prepared to customers' exact requirements. No shop should be without the Ryerson Stock List (see advertisement below).

Thousands of manufacturers report saving considerable time, trouble and money by taking advantage of Ryerson's complete flame cutting service. Modern equipment manned by specially trained operators can quickly burn any shape—no matter how intricate—from carbon or alloy steel plates and billets up to 15" thick.

THE RYERSON UNIQUE 5 point program

EVERYTHING IN STEEL

Ryerson carries the largest and most complete steel stocks in America . . . carbon steels, alloys, stainless, etc., in every size, shape and form . . . a ready, reliable source of supply.

CERTIFIED QUALITY

Ryerson Certified Uniform High Quality Steels meet exacting, narrow range specifications . . . an important advantage, especially with alloy steels, where chemical content, heat-treating response and other characteristics must be known with certainty to assure best results in less time.

IMMEDIATE SHIPMENT

Fast delivery is assured from all ten conveniently located Ryerson plants . . . no order too small for prompt, personal, attention or too large for immediate shipment.

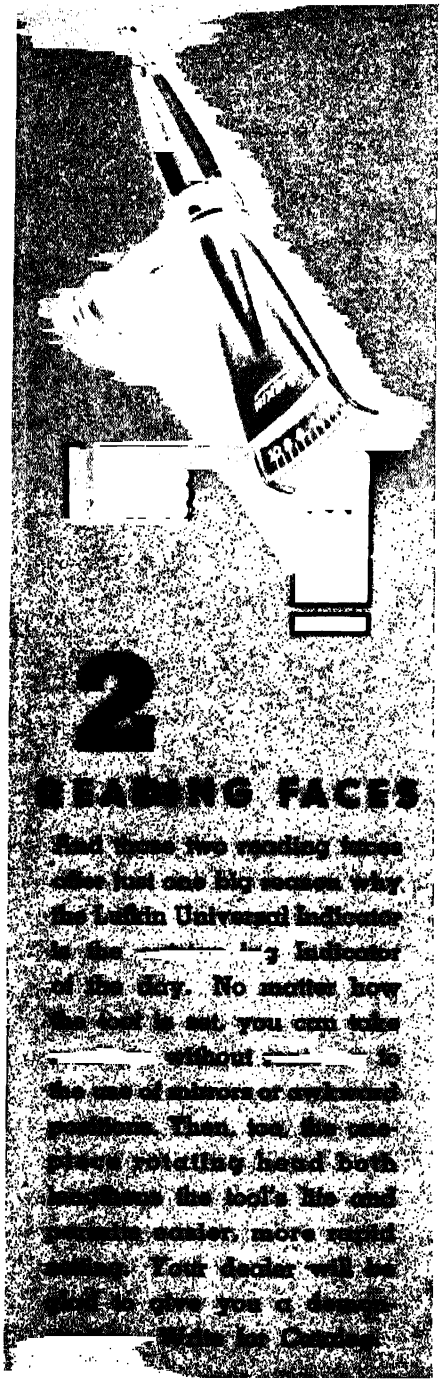
PRODUCTS INCLUDE:
Structurals
Bars
Plates (15 kinds)
Sheets (25 kinds)
Strip Steel
Alloy & Tool Steels
Stainless
Shafting
Mech. Tubing
Boiler Tubes
Welding Rod
Babbitt, Solder
Reinforcing
Nails, Rivets, etc.

RYERSON CERTIFIED STEELS

RYERSON *Certified* STEEL·S

Joseph T. Ryerson & Son, Inc. Plants at: Chicago, Milwaukee, St. Louis, Cincinnati, Detroit, Buffalo, Cleveland, Boston, Philadelphia, Jersey City.

UFKIN
UNIVERSAL INDICATOR



UFKIN
SAW MICHIGAN · New York
RULES PRECISION TOOLS

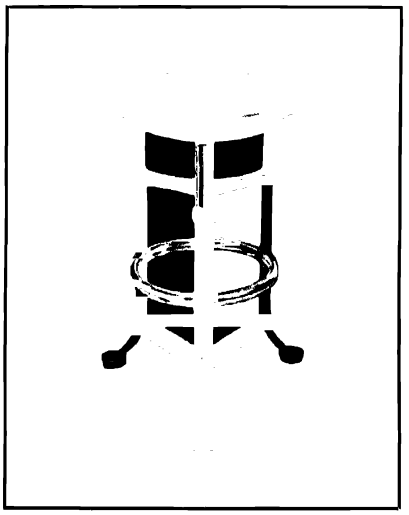
100-Amp. Pull-Out Control Developed by Cutler-Hammer

A line of 100-amp. pull-out type service control has been announced by Cutler-Hammer, Inc., 205 N. Twelfth St., Milwaukee, Wis. The switch is available with or without branch circuits, being rated at 230 volts a.c. It is also available with two 60-amp. pull-outs; and 4, 6, or 8 plug fuse circuits rated at 115/250 volts.

Features include dead-front construction; bakelite switch base; 3-wire grounded solid neutral; and new type solderless lugs. The device is available in surface or flush mounting types.

"Vitek" Adjustable Stool Does Not Require Tools

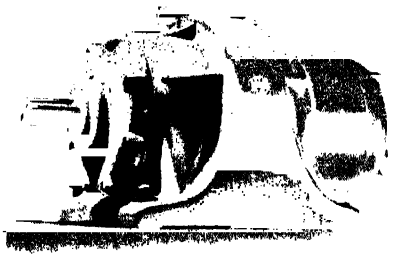
No tools are required to change position of the automatically adjustable "Vitek" stool developed by Dependable Mfg. Co., 122 N. 11th St., Omaha, Nebr. Suitable for laboratories, plants and drafting rooms, this stool is light in weight, and requires only a second to select any desired height. A permanently adjustable locking screw and a foot rest which travels up and down with the seat are among its features.



Browning Oilproof "Gripbelts" Resist Solvents, Acids, Heat

Heat, oil, gasoline and similar agents which deteriorate ordinary rubber V-belts are claimed to have no harmful effect on the oilproof "Gripbelts" developed by Browning Mfg. Co., Maysville, Ky. These belts are also resistant to acids, alkalies and other strong chemicals.

Belts are claimed to contain no rubber, being made entirely from synthetic gums. Although they can generate static, they are claimed to be non-sparking.



Large "Syncrogear" Units Employ Triple Reduction

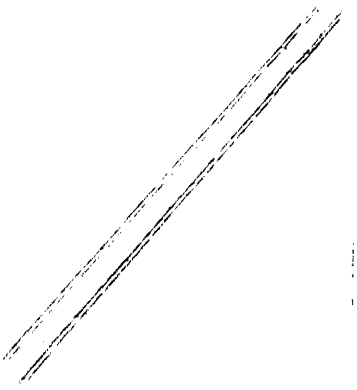
Double and triple reduction geared motors up to 30 hp. at 91 r.p.m. have been added to the "Syncrogear" line offered by U. S. Electrical Motors, Inc., Dept 23, 80 34th St., Brooklyn, N. Y. These units incorporate a pyramidal gear pedestal design to provide ample support to withstand the heavy stresses of high torques.

All castings used in these motors are normalized, assuring permanent alignment of bearings and gears. Both primary and secondary gears dip in a large oil reservoir, providing an ample oil supply to all bearings and gears without submerging any rotating parts.

Straight Aluminum Ladder Weighs Only 1 Lb. per Ft.

A straight aluminum ladder, weighing only 1 lb. per ft. but strong enough for all ordinary uses, has been introduced by Aluminum Ladder Co., 104 Adams St., Tarentum, Pa. Extreme light weight of this ladder permits easy portability and low cost. It is recommended for such purposes as oiling and making general repairs.

Ladder is constructed entirely of 61 S.T. aluminum alloy, having a tensile strength of 48,000 lb. per sq. in. Side rails and ¾-in. round rungs are claimed strong enough to support the heaviest workman. Ladder can be supplied in numerous sizes up to 16 in. wide and 30 ft. long, and may be fitted with safety shoes if desired.

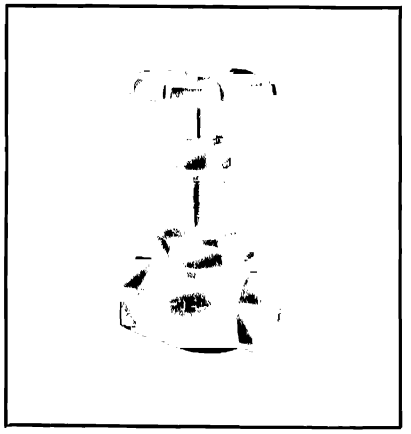


Cathodic Cleaning Compound Made Available by Cowles

Cowles Detergent Co 10525 Carnegie Ave, Cleveland Ohio has announced its MC metal cleaner which is suitable for still tank work and which is highly recommended for cathodic cleaning of steel, brass and copper This cleaner is a medium pH material of unique anionic balance, containing an effective detergent accelerator It is readily soluble, cleans fast and rinses rapidly It is claimed to be economical to use because it is technically anhydrious in composition, thus chemically clean metal can be obtained by using low concentrations

Bronze Globe Valve Designed for Throttling

The Fig 531-P bronze globe valve made by Reading-Pratt & Cady Div American Chain & Cable Co Reading, Pa has a full-plug type seat and



disk and is designed for throttling service on high-temperature high-pressure steam lines It is also suitable for use on high-pressure lines carrying boiler scale and other gritty substances which quickly wear ordinary seating materials Body of this valve is of special hard bronze Disk and seat are of stainless steel of 500 Brinell hardness Stem is of high-strength wear-resisting bronze

Resistance Forge Welding Aided by Special Timer

The recently announced resistance forge welding process which permits spot welding of heavy iron and steel sections and which requires a complicated sequence of accurately timed operations is made possible through a specially designed electronic welding timer developed and built by Weltronic Corp, 2832 E Grand Blvd, Detroit, Mich

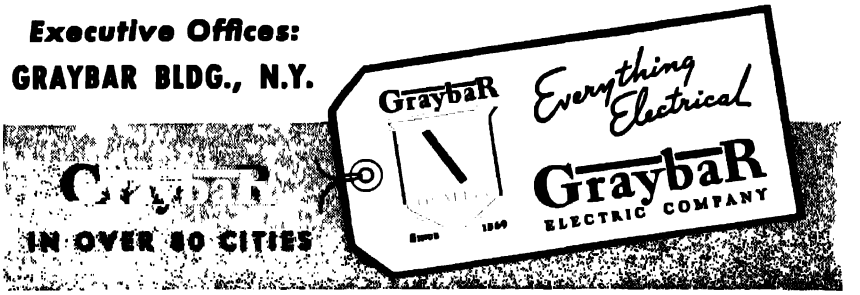
This timer provides accurate control for the various operating sequences required for the process which are low weld current, high



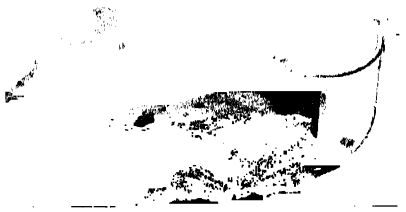
Save-ty and safety go hand in hand when you turn to the Square D line of enclosed industrial switches. A full range of types and capacities meets every requirement for motor disconnects, sectional disconnects in factories, disconnects on industrial furnaces, and the like It was Square D, remember, which developed such features as unit base construction, multi-spring jaws, high-speed break, positive pressure fuse clips, arc suppressors, keyed interlock

The Square D "Type A" Safety Switch meets rigorous needs for heavy duty industrial service "Type C" meets all intermediate service demands Both are promptly available via GRAYBAR in the size and type you require Write GRAYBAR today for catalog giving complete mechanical and electrical specifications.

Executive Offices:
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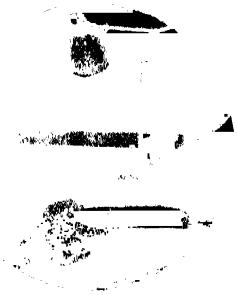


ARMOR PLATE OR MATCH PLATE . . . IT'S ALL THE SAME TO A DoALL



FIRST AID TO OUR *DEFENSE* PROGRAM

Top illustration shows a DoAll cutting out holes on flask dowels in aluminum match plate for metal patterns.



In the circle armor plate is being cut at the rate of 40 square inches per hour.

FASTEST PRECISION METHOD

For cutting internal and external shapes from any metal up to 10" thick. DoAll replaces shaping, milling and lathe work with enormous savings of time, labor and material.



In designing DoAll Defense Tools, DoAll engineers use this big board with drafting machine on an overhead crane.

Let a factory trained man bring a DoAll to your plant and show you what it can save you.

FREE *Handbook on Contour Machining, 158 pages of valuable metal working helps.*

CONTINENTAL MACHINES, INC.

1310 S. Washington Ave., Minneapolis, Minn.

☐ Send data on the DoAll AM-12
☐ Send free Handbook

Name .....

Address .....

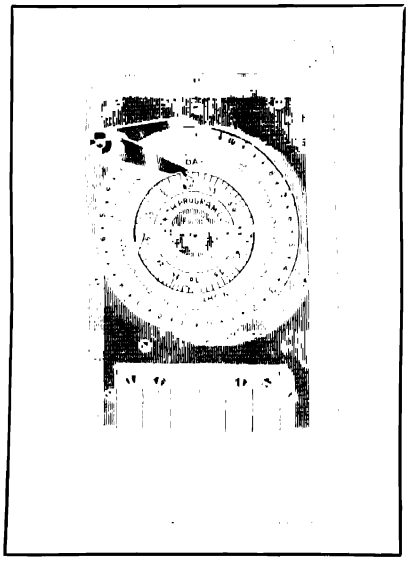
weld current; initial (low) welding pressure; impact forging (high) pressure; cool time; hold time. In addition, the device times virtually any combination of functions required in spot welding heavy sections within the scope of the resistance forge welding process, and can be used with any equipment capable of handling such work, whether standard or special.

Automatic operation of the Model 79 timer eliminates the necessity for skill on the part of the operator, even though fabrication of heavy sections is required at speeds which compare favorably with those of spot welding sheet metal.

Zenith Program Clocks Operate Signals Often

Signals can be operated in any five minute period with the Type P 512 and at any one minute period with the Type PD 124 synchronous program clocks made by the Zenith Electric Co., 845 S. Wabash Ave., Chicago, Ill. These clocks have a large 24-hour dial and a one-hour dial cam. Pointers connected to a contact arm ride the dials and permit the contact arm to fall only when preset time is reached.

These units are operated by heavy duty synchronous motors, with contact arrangements such that accuracy is assured. Contact can be so arranged as to operate a signal either in one ring or a coded ring, or for a definite time from 2 to 6 seconds.



100-Watt Fluorescent Lamps Offered by Hygrade Sylvania

Hygrade Sylvania Corp., Salem, Mass., has developed the "Miralume" F-230 fluorescent lighting fixture to incorporate the new 100-watt Hygrade fluorescent lamps. This fixture comes complete with two 100-watt lamps, each 5 ft. long, completely wired and ready for use.

"American" Speed Reducers All Have 13:1 Ratio

Only five reduction units, each with a 13:1 ratio, are claimed by American Pulley Co., Philadelphia, Pa., to cover all applications from ½ to 30 hp. and to provide any desired speed between 11 and 215 r.p.m. with standard equipment. In addition to these helical gear reduction units which are mounted directly on the shaft of



the driven machine, a standard belt drive between the motor and the input shaft of the reduction unit is used to vary ratios from the 13:1 of the gear reducer. Since the gear reduction unit mounts directly on the shaft as easily as the conventional pulley, no additional space is required.

NEW MATERIALS

New Grade of "Kennametal" Is 15 Per Cent Stronger

A straight tungsten carbide which is claimed to be approximately 15 per cent stronger than any other tungsten carbide of the same hardness has been placed on the market by McKenna Metals Co., 103 Lloyd Ave., Latrobe, Pa. Known as "Kennametal" Grade K4, this carbide tool material has a hardness of 92.0 Rockwell A and strength of 223,000 lb. per sq. in. (transverse rupture test). Due to its high thermal conductivity, together with its unusually high wear resistance, it is particularly applicable to machining hard, crumbly materials such as cast iron, Bakelite, porcelain, hard rubber, glass, casein, silicon aluminum, hard bronze and other non-ferrous materials. The increased strength of Grade K4 is particularly desirable when taking rough cuts or interrupted cuts on hard metals.

Jessop Aircraft Steels Include Bar Products

Jessop Steel Co., 595 Green St., Washington, Pa., has announced that its production of special alloy steels for the aircraft industry has been ex-

tended to include heat-treated and cold-drawn annealed bar products. Manufacture of Jessop aircraft steels was formerly confined to sheets and plates.

S.A.E. steels of the various alloy series, such as 2300, X4130, and 4340, are now supplied in bar form to meet the physical requirements for such parts as bolts, U-bolts, studs and other stressed parts. They are available in the principal analyses required. All such steels are melted in electric furnaces, rolled to close tolerances, and Magnaflux tested to meet requirements of Government specifications for aircraft.

Lincoln "Planeweld" Electrode Suitable for Aircraft Welding

Lincoln Electric Co., 12818 Coit Rd., Cleveland, Ohio, has developed the "Planeweld" arc welding electrode especially for welding SAE-4130 and X-4130 chrome molybdenum steels, which are widely used in airplane construction. This electrode is suitable for welding in all positions, and when used on steels of the types mentioned provides weld metal with physical properties similar to the metal welded. Its welds are smooth without undercutting. There is minimum spatter and good crater conditions. Welds made by the electrode on such steels respond to heat-treatment quite similarly to the parent metal.

"Planeweld" comes in two types, No. 1 for material 0.120 in. thick and heavier, and No 2 for light gage airplane parts and airplane tubing The electrode is available in four sizes: No. 1 in ⅛ and $\frac{5}{32}$ in., and No 2 in $\frac{1}{16}$ and $\frac{3}{32}$ in

"Speed Case" Steel Has Free-Machining Properties

Speed Case Plate Div., of W. J Holliday & Co., Hammond, Ind., has developed "Speed Case" low-carbon open hearth steel plate for use where free machining properties are essential. This material, it is said, can be machined without tearing and without the use of cutting oils.

Capable of being machined at speeds up to 250 surface ft. per min., "Speed Case" is said to be ductile, resistant to impact and abrasion. Physical properties include tensile strength up to 72,000 lb. per sq. in. Plate 4 in. thick shows Brinell hardness from 141 to 156.

The material derives its name from the fact that it can be carburized in a fraction of the time usually required by similar steels. Penetration is deep, with a uniform case of from 62 to 66 Rockwell C, combined with a tough core that averages from 15 to 27 Rockwell C. The metal is recommended for forging, cold forming, pressing, as well as for machining. It can be readily welded.

"YANKEE" VISE



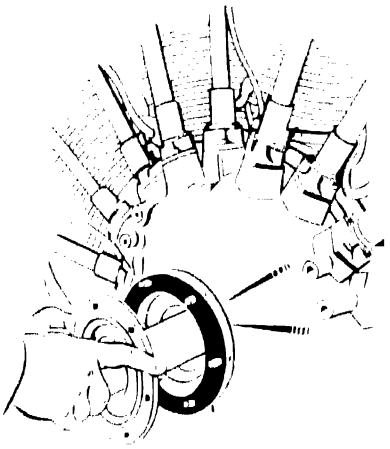
"YANKEE" VISE No. 993 CONVERTED INTO DRILLING AND TAPPING JIG

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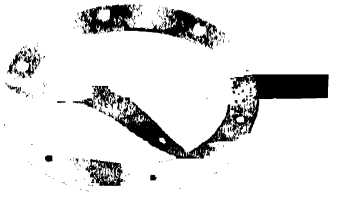


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TRADE PUBLICATIONS

AUXILIARY RELAYS A four-page illustrated booklet containing descriptive, construction, and electrical and mechanical data on auxiliary control relays is being circulated by Department 7-N-20, Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

CIRCUIT BREAKER Bulletin No. GEA-2164A, circulated by General Electric Co., Schenectady, N. Y., describes the construction and operating advantages of circuit breakers operated in oil.

DIES A four-page illustrated booklet, No. 11, Meehanite, the Metal for Cast-to-Form Dies," includes a table of properties available in Meehanite dies as well as a variety of applications and performance records.

ELEVATORS & CONVEYORS C. O. Bartlett & Snow Co., Cleveland, Ohio, is distributing a new general catalog, No. 90, which gives complete details of elevators and conveyors, chains and sprockets, crushers, gates and miscellaneous equipment.

MATERIAL-HANDLING The Industrial Truck Statistical Association, 208 S. La Salle St., Chicago, Ill., has published a practical guide for the systematic study of material handling and the correct application and use of power industrial trucks under the title "Material-Handling Handbook" based largely on the composite experience of American industrial companies. Various practical operating hints covering routing, dispatching, arrangement of aisles, and other problems of material-handling are presented. All sections of the handbook are applicable to any industry and any plant, whether large or small. Copies are being distributed free to those actually engaged in material-handling work, or to general executives concerned in the economics of handling. To others a nominal charge will be made to cover cost of printing and mailing.

PRESSURE FILTERS Bulletin No. W-210-B26, circulated by Worthington Pump & Machinery Corp., Harrison, N. J., provides descriptive material regarding pressure filters for water purification. Bulletin No. W-210-B-27 describes the construction and operation of a hot process water softener for boiler feed water purification.

PROTECTIVE PAINTS American Marietta Co., Chicago, Ill., is circulating a maintenance painting handbook which aids in the proper selection of paints for surface protection.

SWITCHES Center & Giveen Co., Berkeley, Calif. has issued a two-page leaflet which describes the application, range, contacts and construction of an automatic pressure switch.

TIME SWITCHES Bulletin No. GEA-2963B, circulated by General Electric Co., Schenectady, N. Y., provides information concerning the advantages and applications of time switches.

VALVES Eaton Mfg. Co., Detroit, Mich., has issued a four-page folder which describes the laboratory testing of valves.

VISES Wesson Co., Detroit, Mich., has issued a four-page folder which illustrates the operation of all steel vises. Prices and sizes are included.

WELDER DATA A four-page folder published by the Pier Equipment Manufacturing Co., Benton Harbor, Mich., offers information on the manually-operated type and on the automatic type welders. A brief description containing the applications of the various sizes made which run up to 50 KVA is also included.

NEW BOOKS

VALUES OF PSYCHOLOGY IN INDUSTRIAL MANAGEMENT—*Personnel Series Booklet No. 43, published by American Management Association, 330 W 42nd St., New York, N. Y. $0.50.*

Containing 36 pages, this booklet includes sections by Bruce V. Moore, Pennsylvania State College, Harold C. Taylor, Western Electric Co., and Edward N. Hay, personnel officer of the Pennsylvania Co. Mr. Moore discusses several ways in which psychology can help industry, Mr. Taylor outlines a test program for an industrial company, while Mr. Hay discusses the problem of inaugurating a test program.

CONCILIATION AND COOPERATION IN COLLECTIVE BARGAINING — *Personnel Series Booklet No. 44, published by American Management Association, 330 W. 42nd St., New York, N. Y. $0.75.*

Comprising 48 pages of discussion, questions and answers, this booklet contains sections by Phillips L. Garman, director of research, International Printing Pressmen & Assistants' Union of North America; John R. Steelman, director, United States Conciliation Service; Merrill Shepard, Pope & Ballard; and G. L. Patterson, thirteenth regional director, National Labor Relations Board. Entitled "How Organized Labor Can Cooperate with Management," the section by Mr. Garman discusses types of labor leadership, the importance of the foremen's attitude and requisites

for union cooperation. Also treated are arbitration agreement procedures, technical trade schools, and other phases of the cooperation problem. "Conciliation Experience in the Prevention of Conflict," by Mr. Steelman, analyzes the functions of conciliation service, gives the backgrounds of commissioners and outlines conciliation procedures. Mr. Shepard, in "Keeping Up to Date on the N.L.R.A.," discusses recent interpretations of the act. In "Problems and Procedures Under the N.L.R.B.," Mr. Patterson reviews employer and employee rights under the act and outlines its operation.

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EMPLOYEE RELATIONS POLICIES: HOW TO MAKE THEM SPECIFIC—*Personnel Series Booklet No. 40, published by American Management Association, 330 W. 42nd St., New York, N. Y. $0.50.*

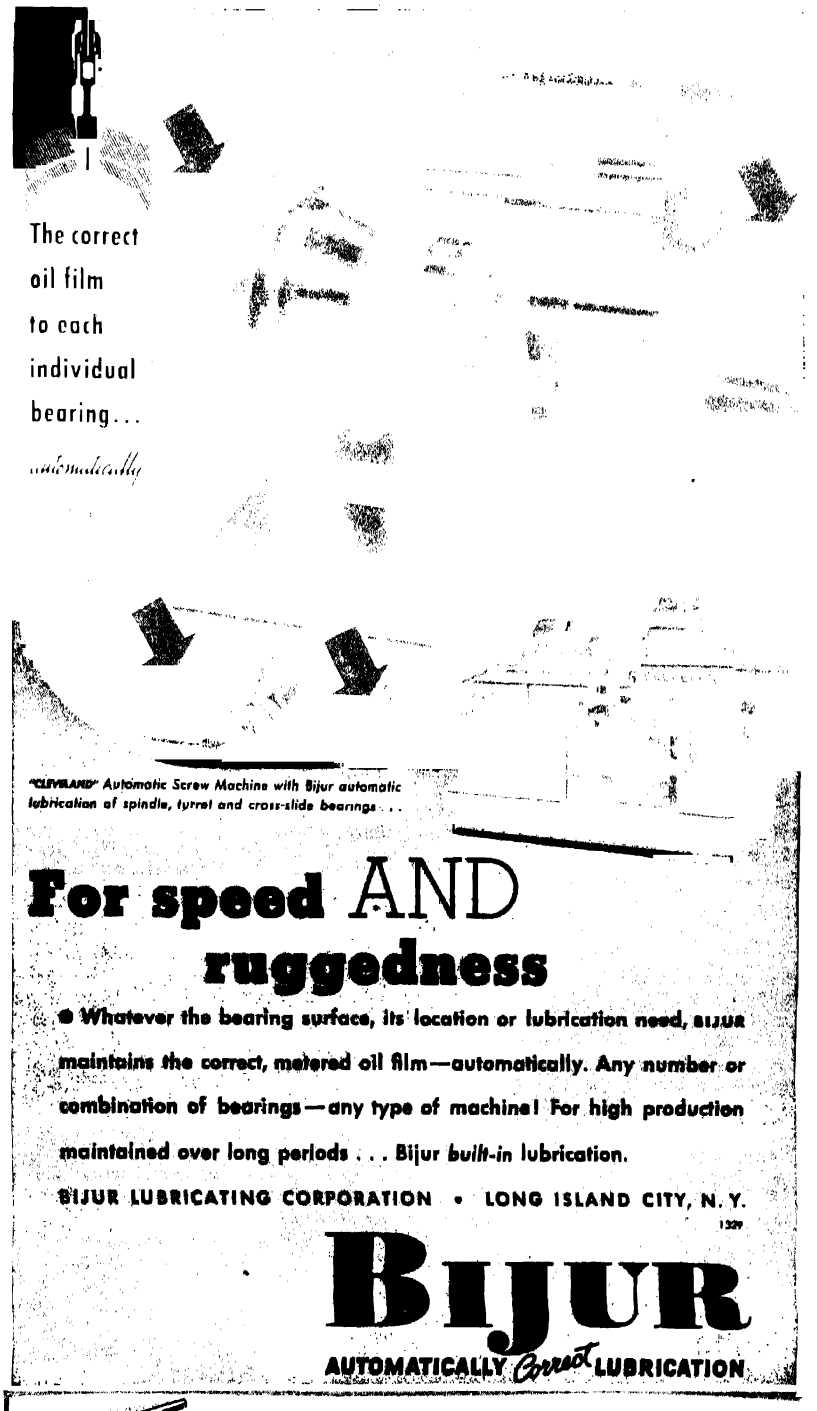
Written by G. B. Hattersley, vice-president in charge of operations for Sears, Roebuck & Company, this 22-page booklet outlines how an operating executive should collaborate with the personnel department in establishing policies. It also discusses ways in which he can induce field executives to make these policies specific. Beginning with a background of employee relations traditions, the booklet discusses profit-sharing pension funds, presidents' reports to employees, and advantages of a strong personnel department. The major portion of the work is devoted to a discussion of joint personnel responsibility and field checks of policies, with several specific rules to facilitate carrying out a program.

•

ENGINEERING DRAWING PROBLEMS. *By Frederic G. Higbee, Sr., M.E., professor and head of the department of engineering drawing, University of Iowa; and John M. Russ, M.S., associate professor in the department of engineering drawing, University of Iowa. John Wiley & Sons, Inc., 440 Fourth Ave., New York, N. Y. $2.25.*

This 9 x 11-in. loose-leaf book presents 114 problems of the completion type, ranging from simple lettering exercises to complicated parts and assembly detail drawings. The complete type of problem is intended to provide a ready means of providing drafting experience in many principles of graphical representation often overlooked. The authors call attention to the fact that, while all important principles and conventions of the graphical language are illustrated, the problems alone do not constitute a course in engineering drawing. The problems are intended to be supplemented by considerable additional work; in fact, the book has been designed to be used with a textbook on engineering drawing.

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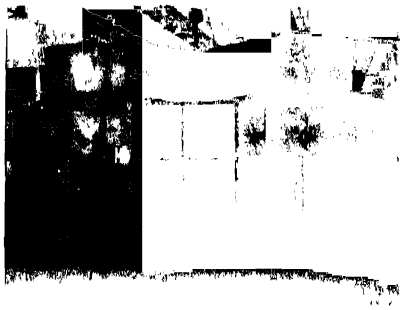
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LABOR ECONOMICS IN A PERIOD OF CHANGE.—*Personnel Series Booklet No 41, published by American Management Association, 330 W 42nd St, New York, N. Y. $0.25.*

What is the economic problem that confronts America today? Is it a problem of guarding against a war boom and a war inflation? Or is it a problem of stimulating recovery and accelerating the absorption of 8,000,000 unemployed? Should we step on the brake or on the accelerator? These and other pertinent questions are answered in this 12-page booklet by Sumner H. Slichter, professor of business economics of Harvard University. The greater part of the discussion is taken up with planning for post-war demands and with analyses of various means for providing a cushion against a post-war slump

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PRACTICAL TECHNIQUES OF INDUSTRIAL TRAINING—*Personnel Series Booklet No. 42, published by American Management Association, 330 W 42nd St., New York, N. Y. $0 50*

Containing sections by L D. McDonald, vice-president, Warner & Swasey Co; Frederick E Searle, superintendent, Henry Ford Trade School; and R. D Hayes, assistant director of personnel relations, American Rolling Mill Co., this 28-page booklet discusses many phases of the training problem, from the selection of apprentices to the teaching of foremen The section by Mr McDonald deals with adapting training courses to meet present special needs, that by Mr. Searle discusses methods for preparing high-school graduates and others for skilled work in industry, while that by Mr. Hayes analyzes methods of teaching foremen how to teach

•

TECHNICAL DRAFTING.—*By Charles H. Schumann, associate professor and executive officer, Department of Drafting, Columbia University. 793 pages. Published by Harper & Bros., 49 E. 33rd St., New York, N. Y. $3.50.*

This book offers one of the most comprehensive and thorough treatments of the various aspects of engineering drawing yet compiled in a single volume. The first part presents elementary principles of the subject, including several topics not hitherto treated in a textbook. Many new problems are provided for the various chapters. The second part represents more advanced work, going intensively into commercial practices followed in various branches of engineering, including welding, construction, architectural drafting, topographical drafting, as well as the more usual branches. Each chapter provides many projects of the same nature as those encountered in engineering drafting rooms, and the problems are designed to be similar to those confronted by professional draftsmen. An unusually large number of illustrations is included in the text

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NEW RESPONSIBILITIES OF THE PERSONNEL EXECUTIVE — *Personnel Series Booklet No. 45 published by American Management Association, 330 W 42nd St., New York, N. Y. $0.50.*

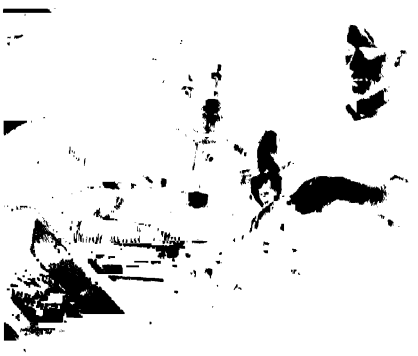
This 32-page booklet contains sections by J. Walter Dietz, personnel relations manager of Western Electric Company; W. A. Patterson, president of United Air Lines; Harold F North, industrial relations manager, Swift & Company, and R. R. Zimmerman, council of personnel administration, United States Government In a section entitled "This Thing Called Personnel Relations," Mr. Dietz traces the development of personnel relations and personnel organization from 1910 to the present time He also analyzes present human research activities and discusses possible future trends. In "Top Management Views the Personnel Job," Mr Patterson conceives the approach as being one of avoiding obsolescence in employees. He also discusses fallacious personnel methods, and tells of ways which his company has found to maintain employee confidence Mr. North in "The Personnel Man's Functional Relationships" reminds employers of employees' rights and privileges, and tells of methods for eliminating grievance causes. In a section headed "In-Service Training for the Personnel Job," Mr. Zimmerman analyzes the requirements and qualifications of personnel men and discusses effective training methods

Correction—Pressures and Blanks for Press Work

Through the courtesy of the Cincinnati Shaper Company, a recently published Reference Book Sheet (*AM*—Vol. 84, pages 933 and 935), gave tonnages for bending sheet metal with "air bend" dies. The fourth paragraph on page 933 stated "The pressure required varies directly as the metal thickness." This statement is incorrect and should read "The pressure required varies approximately directly as the square of the metal thickness."

AMERICAN MACHINIST

December 25, 1940



For Spitfires—*Cartridges from a Canadian arsenal travel a long way before they leave the business end of a machine gun over the Channel*

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VOLUME 84 — NUMBER 26

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AMERICAN MACHINIST

WHAT'S IN THIS ISSUE

CANADIAN CONTRIBUTIONS

With the British pushing their recent gains, it is only fitting that in this issue we dedicate the Armament Section to Canada's efforts to aid England in her hour of need. For, to an island nation beleaguered by bombs from the air and shells from France, production in centers beyond the reach of enemy guns and planes assumes ever-increasing importance. It is indeed gratifying to detect brief news items of Canadian-made guns and munitions getting in effective work against the totalitarian powers. Canada, truly, carries on.

As you will learn in greater detail from "Anti-Aircraft Gun Barrels," which begins the section labeled "Canada Carries On," typical metalworking companies in the Dominion have been setting somewhat of a record in getting into production for munitions items. For instance, a plant having no previous experience in making the Bofors gun passed the first completed barrel through inspection only fourteen weeks after production was begun. At no time has it fallen below its quota. The story of this achievement begins on page 1070.

SHELL FORGINGS

Also under the "Canada Carries On" heading of this number's Armament Section is what we consider a bang-up article on forging 3.7-in. shell. The methods employed are tried and proved over long service. Production is well over 100 forgings per hour per unit, which is not to be sneezed at. With so many U. S. concerns taking on additional defense work, much of it on shell and shell forgings, we feel you'll be tremendously interested in the story beginning on page 1080, entitled "3.7-In. Shell Forgings."

INSIDE AN ARSENAL

While Canada's private industry is doing its best to share the load of supplying England's forces with machines of war, the Dominion Arsenal is far from idle. Products of this arsenal include small arms ammunition and cartridge cases for the smaller sizes of artillery ammunition. From a recent peacetime low it has quickly jumped to true mass-production of ammunition while other facilities are in the process of preparation. Details of the methods employed are given in "Bullets for Britain," which starts on page 1087. All the facts in this story, as well as the other two in the "Canada Carries On" section, were prepared with the full cooperation of the Canadian government and passed by the Canadian censor.

STOP SABOTAGE

Recent fires, explosions and miscellaneous plant disasters have naturally raised the cry of sabotage in the lay press. Coincidence or not, it is in times of increasing production and general expansion that such disasters are most likely to occur. Next in violence to an explosion ranks fire, which can wipe out thousands of dollars worth of new plant, equipment and work in progress in the time it takes the fire department to arrive. All fires start as little ones, and if they can be put under control immediately only slight damage may result. Hence we recommend Leonard F. Maar's story on page 1059. As a member of the Safety Research Institute, Mr. Maar has proposed a logical, simple system of extinguishing plant fires when they're mere flickers.

BLANK

On page 1060 the series on the cold working of sheet aluminum continues with its second installment devoted to the blanking of sheet stock. This particular article, written by J. T. Weinzierl and A. C. Heintz of the Aluminum Company of America, gives detailed recommendations for eliminating troubles and stepping up output.

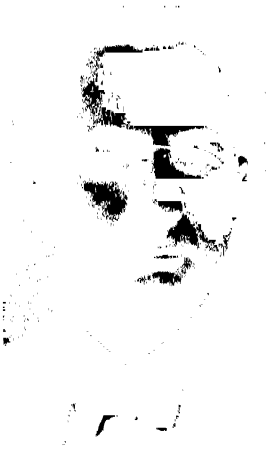


J. T. WEINZIERL
AND A. C. HEINTZ
bigger, better blanks

Line drawings help explain the various points, while tables provide actual operating data as to die clearances, scrap allowances, and so on.

LONGER LIFE

With every effort being made to get the utmost out of machine tools, the problem of tool life naturally becomes of increasing concern. Especially with the accuracy of many machine set-ups dependent upon the tool's resistance to wear, the question of tool life becomes of still greater

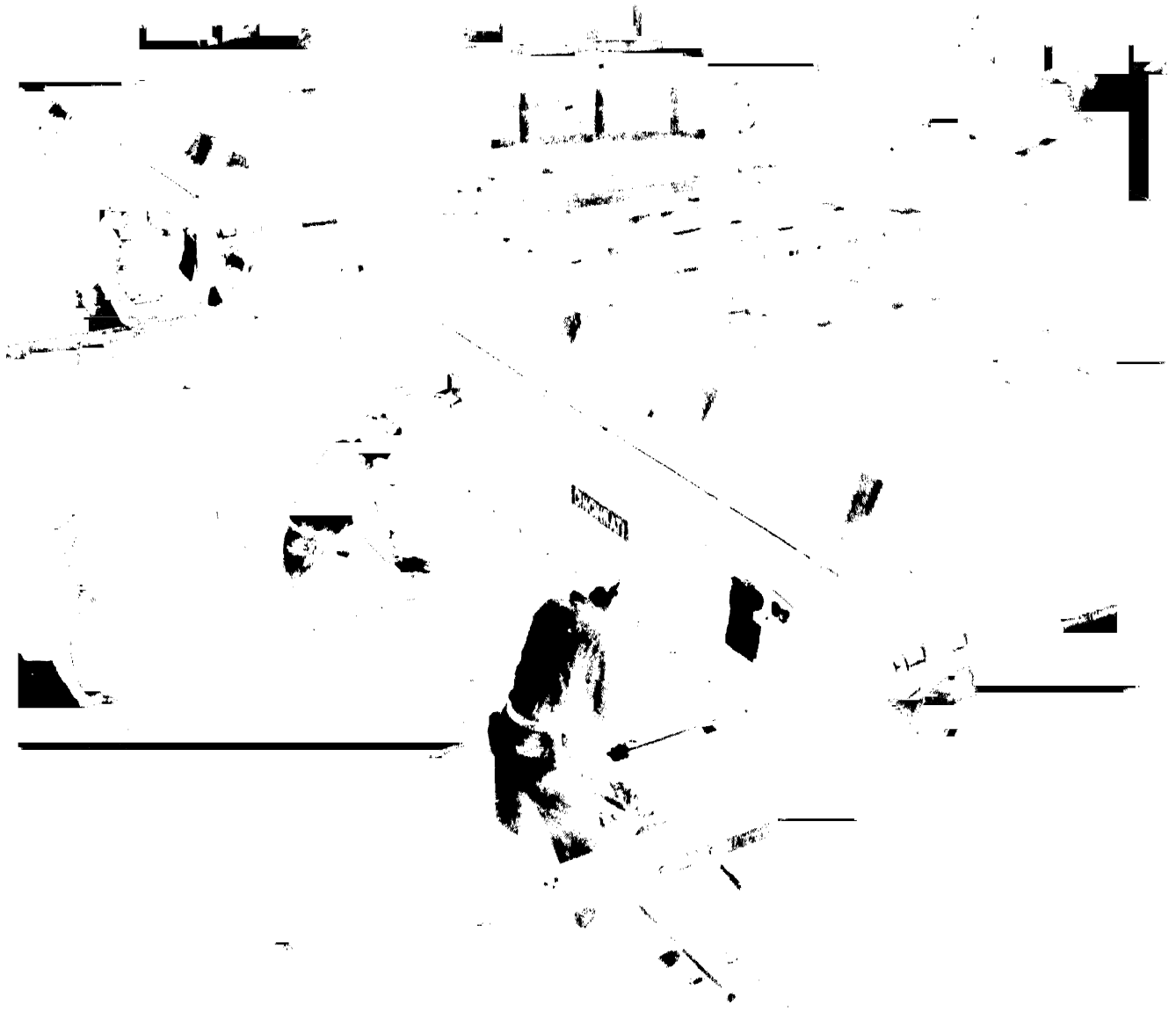


GEORGE M. CLASS
. . . for longer life

importance. Therefore we know you'll get a lot of useful information out of George M. Class's article on page 1055. Mr. Class is vice-president of Gisholt Machine Company, and his long experience with tooling high-production machines has enabled him to cram much data and sound advice into his article. In it, too, you'll find helpful formulas and clear diagrams.

COMING

So long as the present national defense emergency continues, you can count on educational munitions articles in AMERICAN MACHINIST's Armament Section. Scheduled for the next number are a description of the manufacture of various parts for the Browning 30-calibre machine gun and a trip through the Rock Island arsenal. Also planned is an article outlining the proper care of broaches, and, of course, the next installment in the series on the cold working of sheet aluminum. You'll find them in the January 8 AMERICAN MACHINIST.



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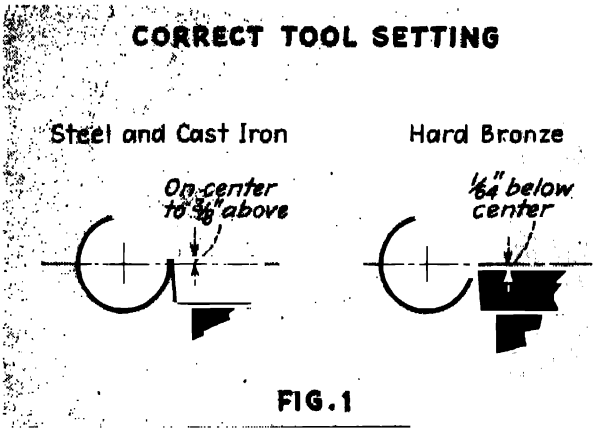
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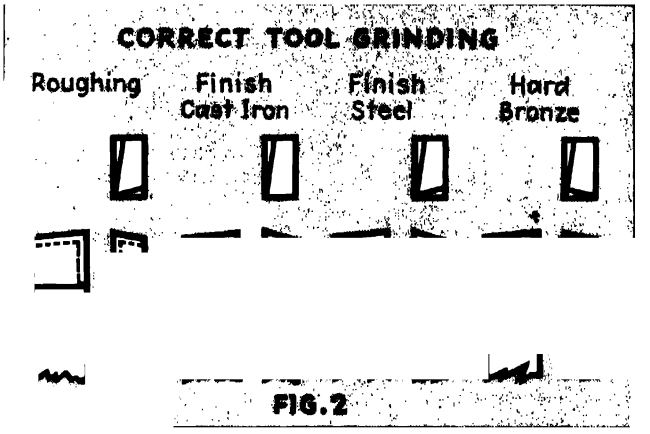


Fig. 1—Tool overhang must be kept at a minimum, with the cutting edge in proper relation with the work

Fig. 2—In general, tool shapes like those shown above work well when cutting the materials indicated

BY GEORGE M. CLASS, VICE-PRESIDENT, GISHOLT MACHINE COMPANY

Cutting speeds which result in 4-hr. life of single-point tools can be calculated by using simple formula. Results check with experience in the field

IN GENERAL, the efficiency of metal turning equipment can be judged by the life of the cutting tool and its ability to remove metal during that time. Life of the tool is affected by the machine on which it is used, method of mounting the tool, condition of the cutting edge, material being machined, finish desired, cutting lubricant used, feed and cutting speed.

Best results can be obtained only when the machine is sufficiently powerful, rigid and accurate to withstand strains caused by the cutting operation. This is especially true with cutting tools which will take higher cutting speeds and rates of feed than are possible with high-speed tools. In the application of cemented carbide tools it often has been found that the power of the machine was not sufficient to maintain the most desirable cutting speed, particularly with several tools cutting at the same time.

Cutting tools must be mounted rigidly. A substantial holder should be used, and the tool overhang must be kept at a minimum. Fig. 1 shows how the tool should be set in the holder for best work and finish when turning steel, cast iron and hard bronze. In the first two cases, it should be placed either on the center of the work or slightly above it to prevent chattering. On large diameter work, the tool frequently is placed as much as $\frac{3}{8}$ in. above the center, where it will operate more successfully than if it were on the center. On the other hand, for hard bronze the tool usually is set below center.

Machine grinding of the cutting edge of the tool is preferable to hand grinding. The face of a cup wheel or the flat side of a wheel is best for grinding the finish clearance angles, so that a curve is not ground in the tool which would reduce its strength. A minimum face angle and end clearance angle are desirable, as is a top rake angle sufficient to make a good cutting edge. For roughing tools, a large nose radius should be used wherever possible with a slight lead angle on the face, about 15 deg. This protects the point of the tool on roughing work where the brunt of the chip load is taken by the body of the tool. Since the main object of roughing is to remove metal, and the series of grooves produced later is removed by a finishing cut, a round nose tool is preferred. The round nose distributes the cutting edge around a greater portion of the tool and so gives it a longer life.

Finishing tools for cast iron and non-ferrous metals usually have

enough land to overlap the feed per revolution, thus producing a very smooth finish since the cutting edge passes over the same surface twice Finishing tools for steel generally have a slight radius on the point To give the cutting edge of the tool good support, it is desirable to reduce the front and side clearance angles as much as possible The top rake angle should be as great as possible, in order to give free cutting action permitting the tool to cut the metal off instead of pushing it off Fig 2 shows the general shape of tools for cutting cast iron, steel and hard bronze Cemented carbide tools will produce a better finish and time between grinds will be lengthened, if they are diamond lapped after being finish ground

It is not uncommon to run for days without grinding the tools when cutting aluminum, whether they be high speed steel or cemented carbide However, when cutting some of the hard alloys, such as SAE 4350 or high carbon car wheel steels it is possible to run only 30 to 60 min before regrinding the tools Here the cemented carbides frequently have shown a considerable saving over high speed steel tools Every metal has a maximum speed at which it can be removed most efficiently When this cutting speed is reached the chip will be cut from the piece and not be sheared or pushed off

For single point tools, finish improves as the speed increases and the feed is decreased When turning steel or cast iron with regular high speed steel tools the maximum cutting speed available which will still leave a cutting edge on the tool is not high enough to produce a smooth finish on the work Instead of actually cutting the metal the tool pushes it off in a series of tears The surface may look smooth to the eye, but examination with a magnifying glass will show the tears to be quite pronounced Using tools capable of operating at higher speeds will give smoother and more accurate finishes

Finish and feed are interdependent The coarser the feed, the rougher the finish and the shorter the tool life However tool life can approach a satisfactory amount by using the proper combination of speed and feed, such as a slow speed and a coarse feed for roughing cuts and a high speed and a fine feed on finishing cuts

Tool life can be increased as much as 20 to 25 per cent by using a cutting lubricant when machining steels This also applies to cast iron in a majority of cases since the oil keeps the tool cool as well as acting as a lubricant between chip and tool Most commonly used types of cutting lubricant are soluble oil lard oil, thread cut oils and kerosene base lubricants for use with aluminum One part of soluble oil mixed with six parts of water is satisfactory on most work A cutting oil is used with cemented carbide tools principally to keep the work cool It does not matter how hot a cemented tool becomes, just as long as the braze between the bit and the shank does not melt

Whenever a lubricant is used, the tools should be liberally flooded and the supply of lubricant should be turned on before the cut is started This is especially necessary when Stellite 2400 or cemented carbides are used These tools are sensitive to violent temperature changes and may crack if they are rapidly cooled

The cutting speed can be so high that the tool will burn up quickly, or it can be so low that the tool life will be exceedingly long As a rule when tools are not difficult to reset cutting speed should be such as to give about a four hour life on roughing cuts and four to eight hours on finishing cuts This does not necessarily hold true for cemented carbide tools since in many cases they last several days without grinding

The relation between cutting feed and tool life, under constant cutting conditions, follows the formula

$$CT^b = \lambda$$

where C = cutting speed measured on the uncut surface of the work, ahead of the tool, in ft per min, T = tool life between grind in min, λ = a constant and b = an experimentally determined constant

The values for b determined from best available data are shown in Table I When using the above formula it is necessary to make a test cut, using a cutting speed high enough to cause rapid tool failure Between 5 and 20



Metal can be removed quickly at reasonable cost when proper cutting materials are used in modern efficient machine tools Here a cemented carbide tool is taking a ½-in cut in a SAE 1045 forging Surface speed on the 15 in diameter is 388 ft per min with an 0.0175 feed

Table I—VALUES FOR CONSTANT "b" FOR DIFFERENT TOOLS AND MATERIALS

Tool and Material Cut	Chip Thickness (Feed) Less than 0.015 in	Chip Thickness (Feed) Greater than 0.015 in
Carbon Tool Steel		
Steel	0.075	0.200
Cast Iron	0.075	0.075
High Speed Steel		
Steel	0.100	0.125
Cast Iron	0.100	0.100
Brass, Bronze	0.290	0.290
Stellite		
Steel	0.140	0.180
Cast Iron	0.140	0.140
Cemented Carbide		
Steel	0.130	0.160
Cast Iron	0.130	0.130

min. is satisfactory. The following example is based on an actual test using Stellite on cast iron:

$C = 250$ ft. per min.
$T = 15$ min.
$b = 0.14$ (see Table I)
$X = CT^b$
$X = 250(15)^{0.14}$
$X = 365$

To find the cutting speed for 4-hr. tool life under the same cutting conditions as the test cut:

$T = 240$ min.
$C(240)^{0.14} = 375$
$C = 158$ ft. per min., the required cutting speed for 4-hr. tool life.

If cutting speed were increased to 175 ft. per min., the tool life would be:

$175(T)^{0.14} = 365$
$(T)^{0.14} = 365/175$
$T = 165$ min. or $2\frac{3}{4}$ hr.

Cutting speeds for 4-hr. tool life calculated by the above method for various metals are summarized in Table II. These speeds are based on information obtained from many of our own tests, and from actual jobs in many shops. The values given are based on continuous cuts using different combinations of feed and depth of cut, with different kinds of cutting tool materials.

The recommended speeds are based on the use of cutting oils. Along the

Table II—SUGGESTED CUTTING SPEEDS FOR TURNING TOOLS

MODIFICATIONS	MATERIAL TO BE MACHINED	H.S.S.	SUPER H.S.S. (COBALT)	STELLITE J	STELLITE 2400	CEMENTED CARBIDE
DECREASE CUTTING SPEED 25 %	X1112	44-161	59-[illegible]	69-246	85-310	253-[illegible]
DECREASE CUTTING SPEED 15 %	1112	33-122	44-149	52-187	[illegible]	[illegible]
DECREASE CUTTING SPEED 40 %	X1314 - X1315	29-105	37-127	45-160	[illegible]	[illegible]
CONTINUOUS CUT WITHOUT LUBRICANT	1115 - 1120	27-100	36-121	43-153	53-193	157-391
CONTINUOUS CUT WITHOUT LUBRICANT	X1015 - X1020	26-96	34-117	41-146	51-185	151-375
CONTINUOUS CUT WITHOUT LUBRICANT	X1330 - 2015 - 2115	25-93	33-113	40-142	49-180	146-364
" "	1010 - 1015 - 1020 - 1025 - 1045 A X1335 - 3115 - 3120 - 3130 A - 4815 4820 - 6130 A	24-88	31-107	38-135	47-170	139-345
" "	1030 - 1035 - 1050 A - X1340 2330 A - 2335 A - 3135 A - 5140 A 6135 A - 6140 A - HYTEN A TEMPER NO. 1 - HYTEN B2	23-86	31-104	37-132	45-166	135-337
" "	X1025 - X1040 - X1050 A - 2315 2320 - 3140 A - X4130 - 4135 A 4140 A - 4615 - 4620 - 6115 6145 A - HYTEN A TEMPER NO. 15	22-82	29-100	35-125	43-158	129-320
" "	1040 - X3140 A - 3145 A 3215 - 3220 - 3230 A - 3415	21-78	28-94	33-119	41-150	122-304
" "	X1045 - 3150 A - 3312 - 4150 A 4340 A - 4345 A - 4640 A - 5120 5150 A - 6120 - 6150 A - HYTEN B3X	20-73	26-89	31-112	39-142	115-288
" "	1045 - 2340 A - 3125 - 3130 - 3230 3240 A - 4340 - 4345 - 4640	19-70	25-85	30-107	37-135	110-274
" "	1050 - 2330 - 3135 - 6125	18-67	24-81	28-102	35-128	105-260
" "	X1055 A - 1055 A - 1060 A - 1065 A 2335 - 2345 A - 2515 - 3140 3150 A - 6130 - HYTEN B4	17-64	23-77	27-97	34-123	100-248
" "	X1065 A - 1070 A - 1075 A - 1080 A T1330 - T1335 - T1340 - T1345 - 2340 2350 A - X3140 - 3150 - 3240 A 3245 A - 3250 A - 3325 - 3335 A 3340 A - 3435 A - 3450 A - 9255 A	16-60	21-72	25-91	31-115	93-233
" "	1085 A - 1090 A - 1095 A - T1350 3240 - 3245 - 3250 - 3335 - 3340 3435 - 3450 - 9255	14-53	19-64	22-80	28-101	83-206
INTERMITTENT CUT WITH WITHOUT	52100 A - 6195 A - 9260 A	13-48	17-[illegible]	21-74	26-93	76-189
25	STAINLESS STEEL - FREE MACHINING	20-73	26-89	31-112	39-142	115-288
15	STAINLESS STEEL - FREE CUTTING	30-112	40-136	48-171	[illegible]	[illegible]
15	CAST IRON - 160-180 BRINELL	40-130	52-168	64-203	70-223	126-396
15	CAST IRON - 227-247 BRINELL	28-92	36-123	45-156	50-172	72-24[illegible]
15	MALLEABLE IRON - 100-140 BRINELL	52-169	67-220	83-270	91-297	148-474
10	CAST STEEL - 115-140 BRINELL	30-100	39-129	48-160	53-176	78-255
20 %	CAST STEEL - 140-160 BRINELL	26-92	34-120	41-148	45-163	67-240
30 %	ALUMINUM	280-920	350-1150	350-1150	385-1265	420-1380
30 %	YELLOW BRASS	85-312	105-375	140-500	154-550	175-625
30 %	ORDINARY BRONZE	35-125	44-156	52-187	57-206	87-312
40 %	HARD BRONZE	21-75	26-93	31-112	34-124	52-187
40 %	COPPER	65-235	78-281	105-375	115-413	131-469
CONTINUOUS CUT WITHOUT LUBR. REDUCE SPEED 25 %	MONEL BAR STOCK 68 % NICKEL - 29 % COPPER 3 % OTHER ELEMENTS	24-185	27-204			
	CAST MONEL METAL - 68 % NICKEL 29 % COPPER - 3 % OTHER ELEMENTS	26-120	29-132			

left-hand side of Table II are modifications applying to the use of the cutting speeds under certain conditions. For instance, in machining any of the materials listed with a continuous cut without a cutting oil, the speed should be decreased 25 per cent. An intermittent cut without a lubricant requires a 40 per cent reduction in cutting speed for most of the materials, but with a lubricant only a 15 per cent reduction is needed. The cutting speed may be increased 50 to 100 per cent on very light finishing cuts.

The cutting speeds given in the table are for a depth of cut ranging from $\frac{1}{32}$ to $\frac{5}{8}$ in., and a feed per revolution from $\frac{1}{64}$ to $\frac{1}{32}$ in. The $\frac{1}{32}$-in. depth of cut and $\frac{1}{64}$-in feed represent the high limit of cutting speed while the $\frac{5}{8}$-in. depth of cut and $\frac{9}{32}$-in. feed represent the low limit. A maximum feed of $\frac{1}{32}$ in. is recommended for all steel cutting with cemented carbide tools. For cast iron, malleable iron, aluminum, brass, bronze and copper, the $\frac{3}{32}$-in. maximum feed may be used under the proper conditions. No figures are given for the machining of either monel bar stock or cast monel metal with Stellite J, Stellite 2400, or cemented carbide tipped tools. Experience to date has shown that these materials can be machined best with high-speed steel tools.

The kind of cutting tool used has a direct bearing on the cutting speed. However, all of the tools listed are very efficient on some work at different cutting speeds. The cutting speeds are given for five different grades of cutting tools. The high-speed steel is the regular 18–4–1 grade. The super-high-speed steels are the cobalt steels. Stellite J is a non-machining cast alloy of cobalt, chromium and tungsten. Stellite 2400 is composed of the same elements, but in different proportions. The cemented carbide tools listed are either tungsten carbide, tantalum carbide, or titanium carbide.

Tantalum and titanium are added to tungsten carbide tools to act as a lubricant for steel chips so that the steel will not tend to crater out and pick up small pieces of tungsten. Although these grades are called tantalum and titanium carbides, the cutting material is still tungsten and the tantalum and titanium act merely as a lubricant to reduce the friction between the chips and the tools. Incidentally, there also are several relatively new grades of high-speed steel which are giving results comparing very favorably to those obtained from cemented carbide tools. Some of these carry a very high percentage of tungsten and cobalt, and a low percentage of molybdenum and vanadium.

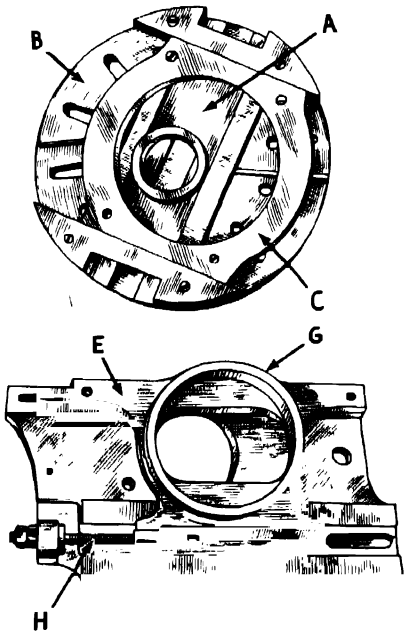
It will be noted that in Table II two cutting speeds are given for each material and each tool. For example, when machining SAE X1112 with high-speed tools and lubricant, the recommended cutting speeds are 44 to 161 surface ft. per min. These are the low and high limits and are dependent on the design of the work piece, the depth of cut, and the feed per revolution. A cutting speed about half way between these two figures should be used when starting the average job. If it is found that the cutting tools will not last for a sufficient length of time, the cutting speed will have to be reduced slightly. On the other hand, if the cutting tools stand up well, a slightly higher cutting speed should be tried. Always run as fast as the tools and the design of the work will permit, since a better surface finish will be obtained. The values given in the table are not hard and fast. In every case, where a new job is run, the operator should try various combinations of speeds and feeds until one is reached which gives the best finish with a reasonable life.

A 50-Year Old Oval Chuck

BY FRED H. COLVIN

CHUCKS FOR TURNING OVALS, sometimes called "wabble" chucks, are not new. The illustration was made from a photograph taken by the writer 50 years ago in a small Philadelphia shop. Such chucks are not used often, but occasional inquiry indicates that some still want them, and two firms are listed as making them. The chuck shown was made to turn punches and bore dies for making the tops and bottoms of oval dinner pails, which was the accepted shape at the time. The cover contained a space for coffee which was heated by setting the cover on any warm object in the shop and, unless the cork was loosened, it sometimes blew out with a noise like a fire-cracker.

Just in case anyone wants to build one the construction can be easily explained. The slide *A* screws on the spindle nose and is held in guides on the back of faceplate *B*. The back of the faceplate also carried another slide *C*, at right angles to *A*. This slide has a large circular opening in the center.



The other part of the chuck consists of the base *D* which bolts against the face of the headstock so that the spindle nose comes through the opening shown. The sliding member *E* has a projecting ring *G* which fits inside the opening in *C* and controls the movement of the face plate *B*. The position of slide *E* is regulated by the screw *H*.

With the ring *G* in the center, concentric with the lathe spindle, work bolted to the faceplate will be turned or bored round. Moving ring *G* off center causes slide *C* to move the faceplate along slide *A* twice during each revolution. This combined movement causes the work on the faceplate to move so that a single-point tool will generate an oval. The amount of oval, or difference between the minor and major diameters, depends on the distance the ring *G* is moved.

Oval boring and turning can also be produced by a cam-controlled cross-slide movement. By either method it is necessary to be sure that the cutting edge of the tool has clearance at all points of the revolution, and is set at the center of the spindle. In practice these oval chucks are quite satisfactory.

Factory fire fighters

BY LEONARD F. MAAR, SAFETY RESEARCH INSTITUTE

MACHINE SHOPS include such a variety of equipment and processes that it is impossible to do more than generalize about fire protection unless the hazards of each situation are considered separately. One important new development in plant fire protection, however, concerns organization of the company fire brigade.

Such a brigade customarily is a central unit. Its members are either on full time fire duty, or are drawn from their jobs in a fire emergency. Their training and drills lead them to think of the plant as a whole, with fire alarm boxes and equipment stations located according to the hazards involved. When an alarm sounds, they drop their work and rush to the source of the trouble, bringing whatever equipment is called for by the scheme of things.

The weakness of this system is the inevitable delay between the time when the trained employee hears the alarm signal and the time he reaches the fire. In those few moments, a small fire might easily get beyond control of first aid equipment and open up sprinkler heads or require quantities of water with consequent damage.

There is a growing tendency, fostered by fire protection engineers, to alter the make-up of the plant fire brigade so that in each department there are men on the spot to combat fire as soon as it occurs. The effect of this system is to reduce the losses from fire and also to reduce the number of fires. The plants of Chrysler Corporation, in the first three years under the departmental system, reduced its fire losses 60 per cent, according to the inspection department of the Association Factory Mutual Fire Insurance Companies.

Fire will break out. In 1938, the last year for which figures are available, the National Fire Protection Association estimated there were 900 fires in metal-working shops alone with losses exceeding $630,000. Indications are that with production increased in many lines this year, the total will be far greater than that, for such is the history of the fire menace. As new employees are added to payrolls, and as new shifts of workmen and shop executives take over their duties, the essentials of fire protection are easily lost sight of in the haste and confusion of readjustment. That is exactly the time when the defenses against fire must be tightened for then the consequences of fire can be greater, destroying more property and more jobs. The national fire loss in January of this year was 31 per cent greater than for the same month in 1939. February showed an increase of more than seventeen per cent.

The hazards of metal-working shops are well known. According to



the N.F.P.A., the fire record in machine shops is as follows:

Heat-treating processes ten per cent
Oil burners eight per cent
Cutting and welding eight per cent
Spontaneous ignition seven per cent
Sparks and friction six per cent
Hot materials or heat igniting combustibles six per cent
Miscellaneous special hazards twenty-five per cent
Electrical causes fifteen per cent
Miscellaneous common causes fifteen per cent

In the building of departmental fire brigades, there are three objectives: prevention, protection, and minimum fire and water losses. The foreman or his assistant may act as captain. He will select as brigade members able-bodied men who are most likely to be constantly on their jobs.

Since brigade members have the fire hazards under their supervision day in and day out, they are more likely to control them carefully as they gain in understanding of the fire potential of each hazard. This makes for increased efficiency in fire prevention.

They should be instructed in the use of fire extinguishers and know what types to use on the various classes of fire. In fact, the fire extinguisher is the first line of defense against fire. Under the departmental system the fire extinguisher detail of the brigade will snuff out most of the fires before they get started.

One group of men should be instructed in laying fire hose so when fires are of greater magnitude than the extinguishers can handle, they will be ready to go into action with streams of water. Another group will act as a salvage corps, covering machinery and materials with tarpaulins to protect them from possible water damage.

The brigade captain generally is charged with responsibility for judging whether or not a fire emergency is severe enough to sound a general plant alarm or to summon the public fire department. He also will deputize one or two men to shut off electric power and motors. The coordination of the departmental brigade with the entire plant fire protection system will depend in a large measure upon the physical characteristics of the property and the hazards involved.

The plant fire chief will respond to every alarm. When he arrives at the scene of a fire, he assumes full command of the fire fighters.

The maintenance of equipment is of first importance in any scheme of fire protection. Fire extinguishers, which have generally supplanted the use of pails of water and sand, should be located at positions that are plainly marked and visible. No obstructions should prevent easy access to them. They should be inspected frequently to make certain they are filled and ready for use, and at least once each year they should be more fully inspected and recharged as directed by the manufacturer. Recharging supplies and replacement parts should be obtained from the manufacturer as the use of sub-standard chemicals or ill-fitting parts may greatly impair the efficiency of the extinguishing unit.

The organization of departmental brigades may take more time and effort than the central brigade system, but it also will be a valuable investment in fire safety.

Blanking and piercing operations

BY J. T. WEINZIERL AND A. C. HEINTZ, ALUMINUM COMPANY OF AMERICA

Cutting of sheet aluminum with press tools is not difficult when a few simple rules are followed. Sharp cutting edges, proper clearances and ample lubrication of work are needed

IN BLANKING ALUMINUM, as in blanking other metals, the tools consist of a punch and a die, the punch being the moving member attached to the ram of the press and the die being stationary on the bed of the press. The material to be blanked is usually in the form of coils or flat sheet which is fed over the top of the die by hand or mechanically. The necessary guides may be attached to the bed by the press or may be part of the tool.

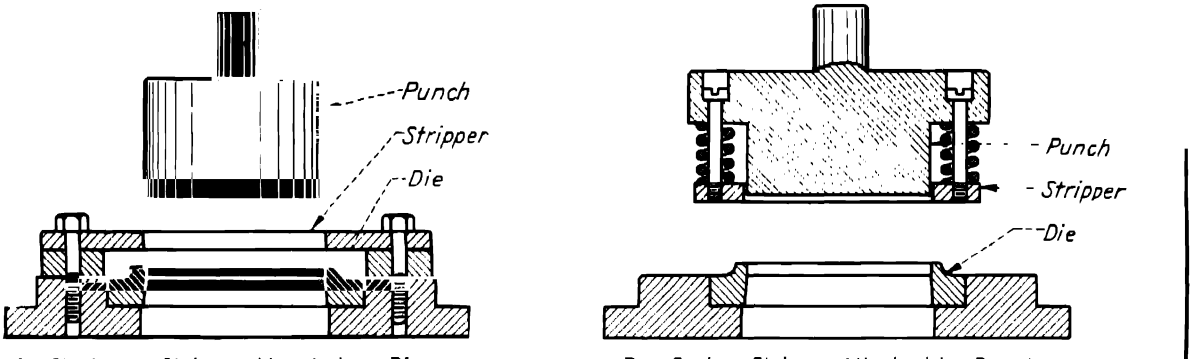
During the operation of blanking, the material being blanked is pinched between the outer edge of the punch and the inner edge of the die. While the blank is pushed into the die and the punch is pressed into the material, a true cutting action takes place and continues for about one-third of the thickness of the material being blanked. The cutting action is followed by fracturing the material for the remaining two-thirds of the thickness. Examination of the edges of the blank will show a bright band indicating the depth of actual cutting, and a wider band showing the fracture.

There are a number of different methods for stripping the scrap from the punch. The two most commonly used are: (1) a stationary stripper, rigidly attached to the die, as shown at *A* in the accompanying sketch; and (2) a spring stripper attached to the punch member, as shown at *B*.

In blanking aluminum, the punch usually is made of annealed tool steel, while the die almost always is made of hardened tool steel. The faces of the punch and die should be ground to insure keen cutting edges. In cases where it is necessary to reduce the load on the press, it is recommended that the top of the die be ground so that the cutting edge is not on one plane around the die opening. One method is to have two opposite points

Table III—PUNCH AND DIE CLEARANCES FOR BLANKING
(t = thickness of sheet in inches)

Aluminum sheet alloy	Clearance		Aluminum sheet alloy	Clearance	
	On a side	On the diameter		On a side	On the diameter
2S-O	0.10t	0.20t	24S-O	0.13t	0.26t
2S-½H	0.12t	0.24t	24S-T	0.16t	0.32t
2S-H	0.14t	0.28t			
			52S-O	0.13t	0.26t
3S-O	0.10t	0.20t	52S-½H	0.14t	0.28t
3S-½H	0.12t	0.24t	52S-H	0.15t	0.30t
3S-H	0.14t	0.28t			
			61S-O	0.11t	0.22t
17S-O	0.13t	0.26t	61S-W	0.12t	0.24t
17S-T	0.16t	0.32t	61S-T	0.14t	0.28t



A – Stationary Stripper Mounted on Die

B – Spring Stripper Attached to Punch

The two methods commonly used for stripping scrap from the punch are the stationary stripper, shown at A, which is mounted on the die or die shoe, and the spring stripper B, attached to the punch



These circular aluminum blanks were produced from strip stock in a No. 675 Bliss double-crank, single-action press having straightening and feed rolls at the right. When cut from the strip, the blanks drop through the die into a chute in the bed of the press

that are high, with low points between them. This is readily accomplished by tilting the die on opposite angles when grinding the top of the die. The difference between the height of the high and low points should be at least one-half of the thickness, but preferably the full thickness, of the material to be blanked. It should be understood when cutting out blanks which must be flat, that the punch should be ground flat and the die may have high and low points. When punching holes in material that must be kept flat, the die should be ground flat and the punch may have high and low points.

Many blanking tools in use have no means of aligning the punch and the die. This puts a great responsibility on the die setter, and there is always a chance of shearing or scoring the punch. Mounting the punch and die in a leader pin die set is recommended since the time needed to set up the tool is shortened considerably and the cost of tool maintenance is reduced.

Table III shows the clearance between the punch and die for blanking various aluminum alloys and tempers. When these clearances are used, the power needed both to operate the tool and to do the stripping of the scrap will be at a minimum. The clearances used in actual practice are about one-half those given in the table to allow for wear that occurs, especially on the punch diameter.

Table IV shows the recommended scrap on the sides and between blanks for various gauges and diameters. Standard mill tolerances on widths for coils and flat sheet were taken into consideration when calculating the scrap allowances given in this table.

Both Sheet and Tools Oiled

Lubrication is essential in keeping tool maintenance costs low. A medium grade of engine oil plus a small percentage of fatty oil diluted with kerosene has been found to give the best results when hard aluminum sheet is being blanked. When the sheet is of a softer alloy or temper, the engine oil and fatty oil mixture is used without dilution. It is desirable to lubricate both the sheet to be blanked and the cutting edges of the tool. By pulling the sheet being blanked between felt pads saturated with the lubricant, a thin film of lubricant will be applied to the surface of the sheet. The felt pads are usually attached directly to the die or on the bed of the press so that the lubricating will be done just before the metal reaches the die. A ring of felt placed around the punch above the stationary or spring stripper may be used for more direct lubrication of the punch. The felt is saturated with lubricant which trickles down to the edge of the punch.

When blanking bright-finished aluminum sheet where it is necessary to

Table IV—SCRAP ALLOWANCES FOR BLANKING

Gage	*Blank Diameter (Dimensions in Inches)*	*Scrap On the Side (In.)*	*Scrap Between Blanks (In.)*
No. 28 Ga. (0.013 in.)	0 to 10 incl.	1/8	1/16
to	10 to 20 incl.	3/16	3/32
No. 15 Ga. (0.057 in.) incl.	20 to 30 and over	1/4	1/8
No. 15 Ga. (0.057 in.)	0 to 10 incl.	5/32	3/32
to	10 to 20 incl.	7/32	1/8
No. 12 Ga. (0.081 in.) incl.	20 to 30 and over	5/16	5/32
No. 12 Ga. (0.081 in.)	0 to 10 incl.	3/16	1/8
to	10 to 20 incl.	1/4	5/32
No. 8 Ga. (0.128 in.) incl.	20 to 30 and over	3/8	3/16



Annealed circular blanks of a common aluminum alloy here are being removed from the conveyor of a continuous furnace

This cone was perforated in sixteen strokes of a horn press The geared feature shown is indexed automatically after each group of holes has been pierced by multiple punches on the ram

maintain the bright finish, it is recommended that the punch and die face be covered entirely with cloth except at the cutting edges The stripper usually is covered with cloth to avoid scratches while the metal is being stripped from the punch A common method of holding the cloth on the various parts of the tool is to use shellac as an adhesive

Piercing is fundamentally the same as blanking, and consists of cutting small holes such as rivet holes, by means of press tools The term blanking is used if the holes are large, or if the part cut out of the hole is the usable portion and the remaining metal, the skeleton scrap Perforating is the piercing of many closely spaced holes

A difficulty commonly experienced when piercing or perforating aluminum is the lifting of the slugs when the punch is moved out of the die on the return stroke of the press To avoid this difficulty the clearance between punch and die should be not more than five per cent of the metal thickness

Piercing and perforating commonly are done in single action presses In making holes in the side walls of hollow ware however, a horn press is used

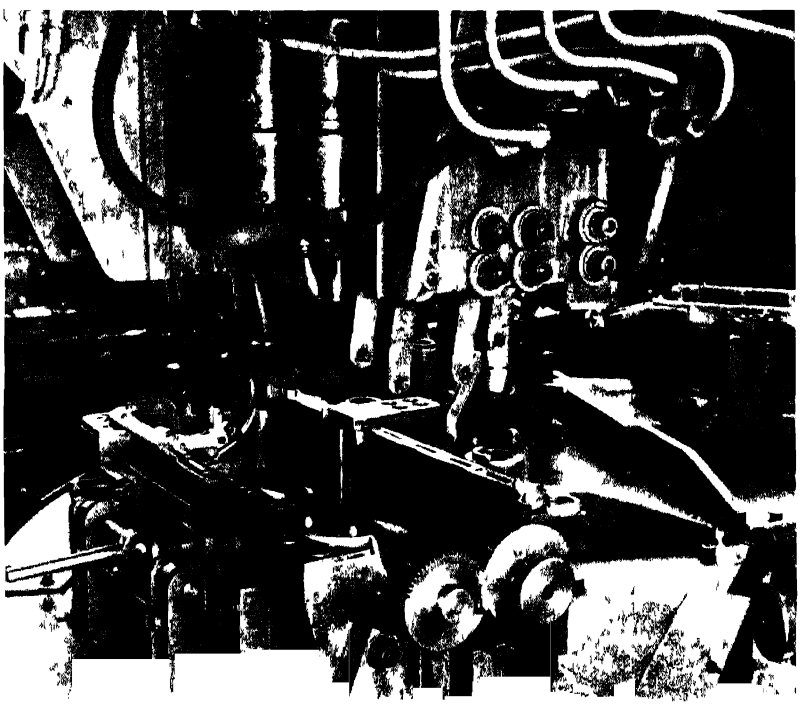
The third article in this series on the cold working of sheet aluminum will appear in an early issue



Dodge welds thin sections to thick with these fixtures

Table-top welding

Toggle operated electrodes reaching down into the oil pan make for short current travel, reduce electrode maintenance, and permit the desirable welding condition of passing current from the thinner to the thicker piece



LONG LEADS to welding electrodes are avoided in the hydromatic type welder installed at Dodge Division of Chrysler Corporation for spot welding various sheet metal parts to oil pans. Electrodes operated by toggles move down into the fixture and weld from the thinner sheet metal pieces to the thicker oil pan. Design of the toggle mechanisms constituted a different problem because of space limitations, but better welding results when it is possible to spot weld from a thin to a thick section.

Five fixtures are spaced around a geneva indexed table. Operators first lay thick reinforcing pieces over two dowel pins at each corner, after which the oil pan is dropped into place. Next two baffle plates are slid into the bottom of the oil pan. Holes in the baffle plates snap over dimples in the pan, no other locating means being required. A channel section that serves as a protector for the oil dip rod is located at one side of the pan by a conventional quick acting pad. Sealer rings at each end of the oil pan are located by a novel gear clamp. Formerly, two individually operated clamps were provided, but the operators desired a single clamp. So the shafts for the two clamps were geared together, and the operator is now required to turn only one knob.

Gear tooth contact

BY C. A. YOUNG

The author clears up some of the confusion surrounding the definition and derivation of the arcs of approach and recession

CONSIDERING two teeth coming into mesh, one tooth first makes contact with the other at the tip of the tooth. That is, the point of contact is the intersection of the outside circle of the one tooth with the involute curve of the other tooth. This point is also the point of intersection of the line of action, since all tooth contact takes place on the line of action. From this initial point, as the gears rotate, the point of contact moves down one involute and up the other, always remaining on the line of action, until it leaves contact at the tip of the other tooth.

This action may be shown graphically. In Fig. 1:

R and R_1 = Pitch radii of gears O and O_1 respectively
R_b and R_{b1} = Radii of the base circles
R_o and R_{o1} = Outside radii
OO_1 = Centers
ϕ = Pressure angle

The line of action is the straight line ABC drawn tangent to the two base circles. The first point of contact is the intersection of the outside circle of gear O with the line of action. That is, point D. Tooth contact proceeds, from rotation of the gears, along line ABD to point E, the last point of contact, which is the point of intersection of the outside circle of gear O_1 with the line of action. The teeth have, therefore, been in contact from point D to point E, along straight line DBE. The line DBE is the duration of contact.

A model will help to make this clear. Cover a board with paper, and on it draw the pitch circles and outside circles of a pair of mating gears. Cut the two base circles of some material at least $\frac{1}{8}$ in. thick and nail them on their respective centers. Now fasten a string on base circle O, Fig. 2, at some point as X, wrap it around counterclockwise to A and jump over to base circle O_1 along line AC. Tie a knot at point B where the string crosses the common centerline and wrap the string around base circle O_1, fastening it at some point Y.

Rotate base circle O_1 clockwise and the knot at B will move to C. Now, keeping the string taut by slightly braking base circle O_1, rotate base circle O clockwise, moving the knot to point D, where it touches the outside circle of O. This is the first point of contact. Further rotation in the same direction will move the knot through point B to point E, where it touches the outside circle of O_1. This is the last point of contact. The knot at all times represents the point of contact of the two involutes of the meshing teeth, and is always on the line of action ABC. The teeth will not touch at any other point or leave the line of action unless there is interference.

For purposes of computation and study the duration of contact (line DBE) has been divided into two parts, DB and BE. Point B is the point of tangency of the two pitch circles. It is also the point of intersection of the line of action and the common centerline. Therefore, the arc of approach is the duration of contact from initial contact to contact at the pitch line, and the arc of recession is the duration of contact from contact at the pitch line to final contact. Thus for gear O, line EB is the arc of approach if the gear is rotating counterclockwise, and line BD the arc of recession. For gear O_1 rotating counterclockwise, line DB is the arc of approach and line BE the arc of recession. Obviously the sum of the two arcs is the total duration of contact (line ED or DE).

Now let us see how this word "arc" crept into the picture when we were considering *straight* lines. Moving the knot from D to B made a definite unwinding of string from base circle O_1 and a definite winding of string on base circle O. Before unwinding, the length of string required for this movement was a length of arc on circle O_1 and involved a corresponding winding of a straight line into an arc on circle O. Thus AC or any portion thereof may be expressed as a length of arc on either base circle O or O_1. So, in Fig. 1, if we are considering the arc of approach of a tooth on O_1 we can express line DB in terms of length of arc to radius R_{b1}, and the arc of recession of a tooth on O_1 as line BE in terms of length of arc to radius R_{b1}. For gear O, the arc of approach would be an arc of length EB to radius R_b and the arc of recession an arc of length BD to radius R_b.

For definitions, then, the arc of approach is the length of arc on the base circle through which a tooth travels from the time it first touches its mating tooth until the two teeth touch at their pitch circles; and the arc of recession is the length of arc on the base circle through which a tooth travels from the time the two teeth touch at their pitch circles until a tooth last touches its mating tooth.

These two arcs may be found mathematically in three different ways:

1. Let θ = angle AOD and θ_1 = angle CO_1E

$$\cos \theta_1 = \frac{R_{b1}}{R_{o1}} \quad (1)$$

$$CE = R_{o1} \sin \theta_1$$
$$CB = R_1 \sin \phi \text{ or } R_{b1} \tan \phi$$
$$BE = CE - CB$$

Arc of approach of gear O
= arc of recession of gear O_1
$$= R_{o1} \sin \theta_1 - R_1 \sin \phi \quad (2)$$
$$= R_{o1} \sin \theta_1 - R_{b1} \tan \phi \quad (3)$$

$$\cos \theta = \frac{R_b}{R_o} \quad (4)$$

$$AD = R_o \sin \theta$$
$$AB = R \sin \phi \text{ or } R_b \tan \phi$$
$$BD = AD - AB$$

Arc of approach of gear O_1
= arc of recession of gear O
$$= R_o \sin \theta - R \sin \phi \quad (5)$$
$$= R_o \sin \theta - R_b \tan \phi \quad (6)$$

2. By squares of the sides of the triangles:

$$CE = \sqrt{R^2_{o1} - R^2_{b1}}$$
$$CB = \sqrt{R^2_1 - R^2_{b1}}$$
$$BE = \sqrt{R^2_{o1} - R^2_{b1}} - \sqrt{R^2_1 - R^2_{b1}} \quad (7)$$
$$AD = \sqrt{R^2_o - R^2_b}$$
$$AB = \sqrt{R^2 - R^2_b}$$
$$BD = \sqrt{R^2_o - R^2_b} - \sqrt{R^2 - R^2_b} \quad (8)$$

3. Also, since θ and θ_1 must be found in either method above, the arcs may be figured thus:

Let β and β_1 = Angles BOD and BO_1E respectively
$$\beta = \theta - \phi \text{ and } \beta_1 = \theta_1 - \phi$$

Two sides and the included angle of triangles BOD and BO_1E are known and therefore sides BD and

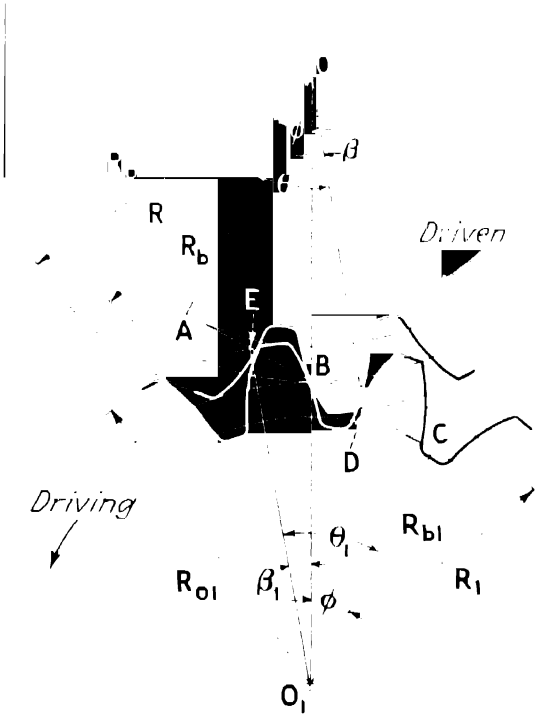


Fig. 1

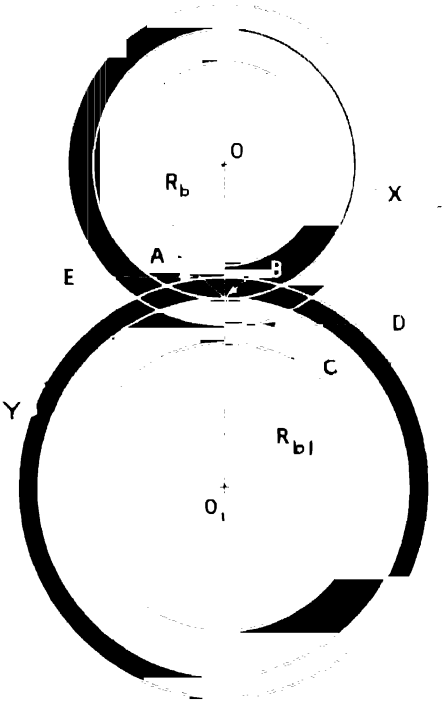


Fig. 2

BE may be determined by solution of these oblique triangles

$$BE = \sqrt{R_{o1}^2 + R_1^2 - 2R_{o1}R_1 \cos \beta_1} \quad (9)$$

$$BD = \sqrt{R_o^2 + R^2 - 2R_oR \cos \beta} \quad (10)$$

In circular measure (radians) the angle of approach, that is the central angle of the gear through which the gear rotates while passing through the arc of approach, is the quotient of the arc of approach for that gear divided by the radius of its base circle, and the angle of recession is the quotient of the arc of recession for that gear divided by the radius of its base circle

$$\text{Duration of contact } DL = \text{Arc of approach } DB + \text{arc of recession } BL \quad (11)$$

The number of teeth in contact at any instant follows directly from the above since we know that any tooth is in contact with its mating tooth for a distance *DL*. The number of teeth in contact at one time is therefore the number of teeth included in this distance. Thus the number of teeth in contact is the quotient of the duration of contact divided by the circular pitch since there is one tooth in one circular pitch. This ratio is called the contact ratio

$$\text{Contact ratio} = \text{Number of teeth in contact} = \frac{\text{Duration of contact}}{\text{Circular pitch}} \quad (12)$$

It might be well to bring up one other point relating to this study that is tip relief and what to do with it in the formulas above. Since tip relief is a true relief, any part of the tooth in the relieved portion does not contact the mating tooth. Therefore the initial and final points of contact will be at the end of the involute (the beginning of the relief) and will be at the point of intersection of this point with the line of action. In other words reduce the outside diameter by twice the depth of relief and use this diameter in the same way as the true outside diameter was used in the above. Thus, if the gear was 20 in O.D. and had 0.125 in. tip relief, use 19.750 in. as the outside diameter.

Machine Tool Designations

THE National Machine Tool Builders Association can make the selection and ordering of machines much easier for purchasing agents and others by a little get together on standardization. It has already done a good job on spindle noses for lathes and milling machines, T slots and toolpost openings. But both names and machine designations leave much to be desired.

Arbitrary numbering of machines instead of designation by capacity causes much misunderstanding and delay. Milling machine numbers are the exception but even here designation by capacity would greatly simplify comparison when ordering.

Engine lathes are satisfactorily designated as to swing, as even the extra capacity beyond designated dimensions is not particularly misleading or harmful. Capacity between centers however is more important than length of bed. But when it comes to turret lathes we have a variety of makes with arbitrary numbers that do not tell the capacity of the machines. They should give both bar stock and chucking capacity.

Planers and shapers are designated by their work capacity but the tool room slotter or vertical shaper and the jig borer usually have numbers that give no clue to the size of work they are designed to accommodate.

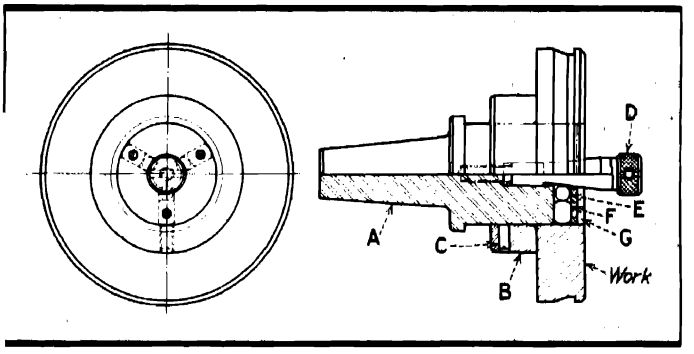
Cylindrical grinding machines and some surface grinders are rated by the size of work that can be done on them. But internal grinders, small boring machines, and even large table and floor type horizontal boring machines are given numbers that are Greek to all but the manufacturers. Cooperation of machine tool builders through the N.M.T.B.A. can work out methods of designating the capacity of different machines that will be of value to buyers generally. This will save the buyer the necessity of looking up different catalogs to compare capacities of various machines.

IDEAS FROM PRACTICAL MEN

Quick-Acting Chuck for Thin Rings

By J. B. BOOTH
Bradford, England

The illustration shows a quick-acting chuck for facing and turning thin bored rings. It consists of the steel body *A* fitted with a tapered shank to suit the spindle nose and a parallel portion which is two and one half times longer than the thickest ring likely to be held and is of such diameter that the ring slides on



This chuck was made for facing and turning large quantities of accurately bored rings. A tapered center plug forces plungers radially against the bored diameter of the work

with a snug fit. A small shoulder is machined at the junction of the parallel and tapered portions of the body.

A collar *B* is bored to a snug fit on the parallel part of the body *A*. The right-hand face of the collar should be square with the bore since it is the locating face against which the work is held prior to clamping. The screw *C* secures the collar *B* to the body *A*. The latter is drilled centrally to take the tapered plug *D*, which is threaded and screws in the hole in *A*. A short parallel section on the plug fits the hole in *A* to prevent the plug from locating itself entirely from the threaded end. The head of the plug is enlarged, knurled and cross drilled to facilitate turning.

The middle section of the plug *D* is tapered approximately 12½ deg. inclusive, and engages with the steel balls *E* located in three radial holes in the body. Plungers *F* bear on the balls *E* and against the bore of the ring to be machined; the plungers are prevented from passing out of the body holes by setscrews *G* which engage small flats or grooves milled on the sides of the plungers. When setscrews *G* are adjusted, plungers *F* should be free to slide in the holes.

In using the chuck, it is trued up on the spindle and the collar *B* is adjusted along the body and clamped so as to permit the right-hand face of the ring to overhang slightly the end of body *A*. After a ring has been placed on the chuck it is held tightly by plungers *F* when the plug *D* is tightened in the body.

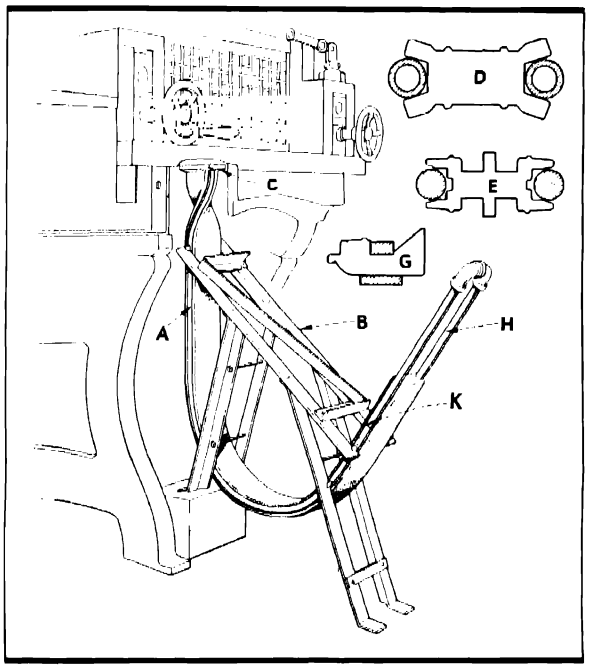
After facing one end and the periphery of the ring, the collar *B* can be withdrawn to take a light cut on the other face, thus completing all operations at one setting of the chuck.

Automatic Blank Stacker Speeds Production

By JOHN E. HOAGLAND

A good stacking device for a blanking press should keep the blanks flat, eliminate abuse of the blanks when they are placed in a tray, and permit unloading while the press is running, especially when an automatic feed is used. The illustrated stacker accomplishes all of these.

It consists of guide rails *A* so spaced to permit the blanks to slide freely; the frame *B* which supports the guide rails; and the plate *C* which is made ½ in. larger than the blank, and fits into the clearance hole of the bolster plate where it is fastened with filister head screws. The guide rails are made of bent pipe or cold-rolled stock, and positioned to suit the shape of the blanks; three types of rails and blanks are shown at *D*, *E* and *G*. The guide rails are welded to the frame.



This stacking device for a blanking press fits into the clearance hole in the bolster and guides the blanks onto a holder which can be removed and preplaced without stopping the machine

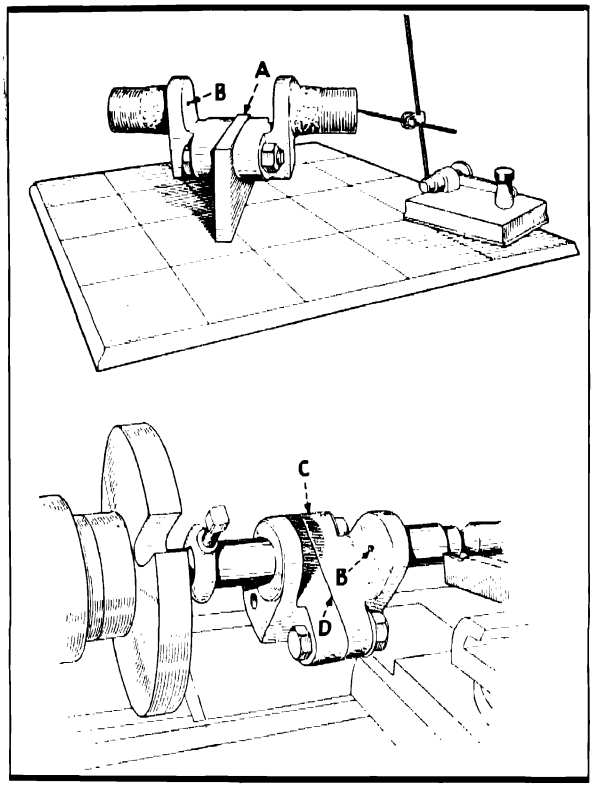
The neck of the illustrated stacker adjacent to the bolster is twisted 90 deg. Other stackers in use at our plant are not twisted, the desirability of using the twist depending on which way is the easiest to deliver the blanks from the die to the curved part of the stacker. This is relative to the shape of the blank.

As the blanks come out of the die, they are guided by plate *C* onto the rails *A* and finally fill up the holder *H*; the latter is a separate piece of the rails and when filled can be detached at joint *K*. The operator grabs the blanks just below joint *K*, removes the holder, places it in a tray, and inserts a spare holder.

Proper Repairs for Locomotive Links

By ARTHUR HAVENS

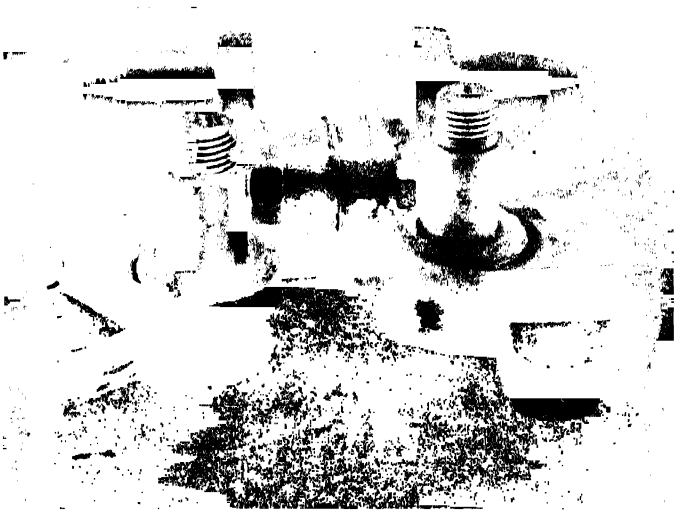
For many years the repair of link bridges on Stevenson valve-gear double hanging links has been a haphazard affair. Usually the worn pins are rebuilt by



Worn link-bridge pins of Stevenson valve gear should be removed, new pins scarfed and welded in place, and centered accurately with the center of the bridge. The centers are located with the bridges bolted to a plane plate. This is removed and the bridges bolted back to back for turning and threading the pins

welding and machined round, completely disregarding the face of the bridge that bolts to the link. To install links so repaired requires heating and twisting the link hangers until they slip on the bridges. Links so hung will never swing freely and the engineman must exert much effort to reverse the gear.

The following repair method eliminates this trouble. Flame cut the pin from the bridge, leaving a 1-in. stub in the center of which is drilled a $\frac{3}{16}$-in. hole $\frac{1}{2}$ in. deep. Drill a similar hole in one end of a piece of soft steel turned $2\frac{1}{2}$ in. in diameter and 3 in. long. Scarf the stub and the drilled end of the new pin, insert a piece of $\frac{3}{16}$-in. welding rod in the stub, mount the new pin on the extending portion of the $\frac{3}{16}$-in. rod, and weld the assembly. Repeat this for each of the three remaining bridges in the



Stevenson link-bridge pins machined concentric with the bridge simplify repairs to the valve gear

link set. Most of the warping can be overcome by welding on alternate sides of the Veed stub and pin.

Usually the face of the bridge that bolts to the link will not be square with the pin. To correct this, the back of the bridge is rebuilt by welding and later machined square with the pin, and to the correct thickness from the link face to the bottom on the pin, using a shaper. Care in this operation determines the success of the entire repair method. If the pins are too long, they can now be cut to length in the shaper.

The bridges are then bolted to plane plate *A*, as shown in the illustration, in the same position as when bolted to the link. A surface gage is used to determine the height of the center hole *B* in each bridge; the surface gage is then set to the average height of these center holes, and a horizontal line is scribed on the end of each pin. The vertical line is found by dividing the length of the plate in half and scribing this distance on the end of the pin wherever it may come. The intersection of the two lines will be the centers upon which the assembly will be turned.

The bridges are removed from plate *A* and bolted together as at *C* for mounting on lathe centers. A sharpened $\frac{1}{8}$-in. drill rod is fastened in the toolpost in such a position that the point touches the seam *D* where the bridges join. The assembly is turned by hand and the pointer manipulated in and out with the movement of the work. If the pin centers are correct, the pointer will follow the seam the entire distance; if not, the centers are changed the amount needed to correct the error. Finally, the pins are turned to diam-

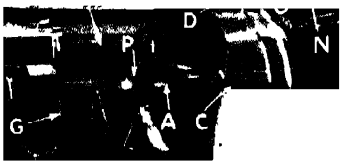
eter and threaded, and the cotter pin holes drilled

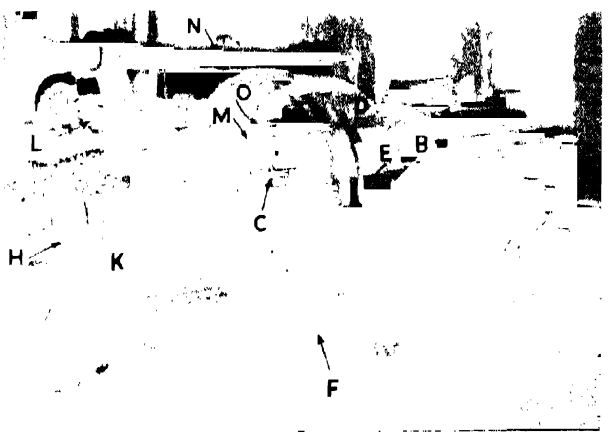
The link hangers are usually in bad shape and to make the job complete they should be checked for length, straightened, and all errors corrected before they are assembled to the links Stevenson links repaired in this manner are easy to assemble, and repairs to link motion at later shoppings of the locomotives are simplified in that it is only necessary to replace link hanger bushings and grind links and link blocks

Large Spider Castings Finished on Shaper

By H E LONG ASSISTANT WORKS MANAGER
Stacy Schmidt Manufacturing Company

We had to machine eleven bronze riser valve units for the water supply system of New York City The central stem *A* and the body *B* of the spider castings were first turned to size on a boring mill leaving portions *C* of the stem between the radial arms and surfaces *D* between lugs *F* on the outside body unfinished These had to be finished on a machine that





The necessary reciprocating cut and circular feed for finishing the stem and outside lugs of this water-valve spider casting was obtained with this fixture mounted on a Gould & Eberhardt shaper

had a reciprocating motion for the cutting tool and a circular motion for the feed The illustrated fixture furnished both these motions

It consists of the cast iron side arms *I* and the fixed center *G* bolted to the shaper table, the live center *H* and supporting bracket *K* which is offset for clearance of spider arm *L* as the spider revolves in the fixture, the shaper ram extension *M* and the over arm *N* bolted to the ram extension *M* Both arms *M* and *N* were slotted for snug fits of toolholders *O*, each of which pivots about a central pin, the toolholders were drilled with holes 1 in apart to obtain major vertical adjustment of the tool Small vertical adjustments were made with the toolbits Tool drag on the return stroke of the shaper was obtained by installing a spring between a stop pin and the top of the tool holder Circular feed of the spider casting was obtained with an integral worm wheel and cast iron sleeve fitted to the spider stem on the dead center end The worm wheel meshed with a worm on a shaft supported by bearing mounted on the shaper table in front of the dead center bracket

When placed in the fixture, the spider had to be aligned perfectly with that part of the stem previously turned on a boring mill This was done by attaching a dial indicator to the arm *M* and indicating first the top and then the side of the spider stem longitudinally, and finally holding the indicator in one position while the spider was turned with the circular feed attachment Necessary vertical adjustment was obtained with the shaper table at one end of the fixture and screw jacks at the other end What little horizontal adjustment was necessary was obtained by two steel brackets imbedded in concrete at each side of the fixture and fitted with a setscrew and locknut

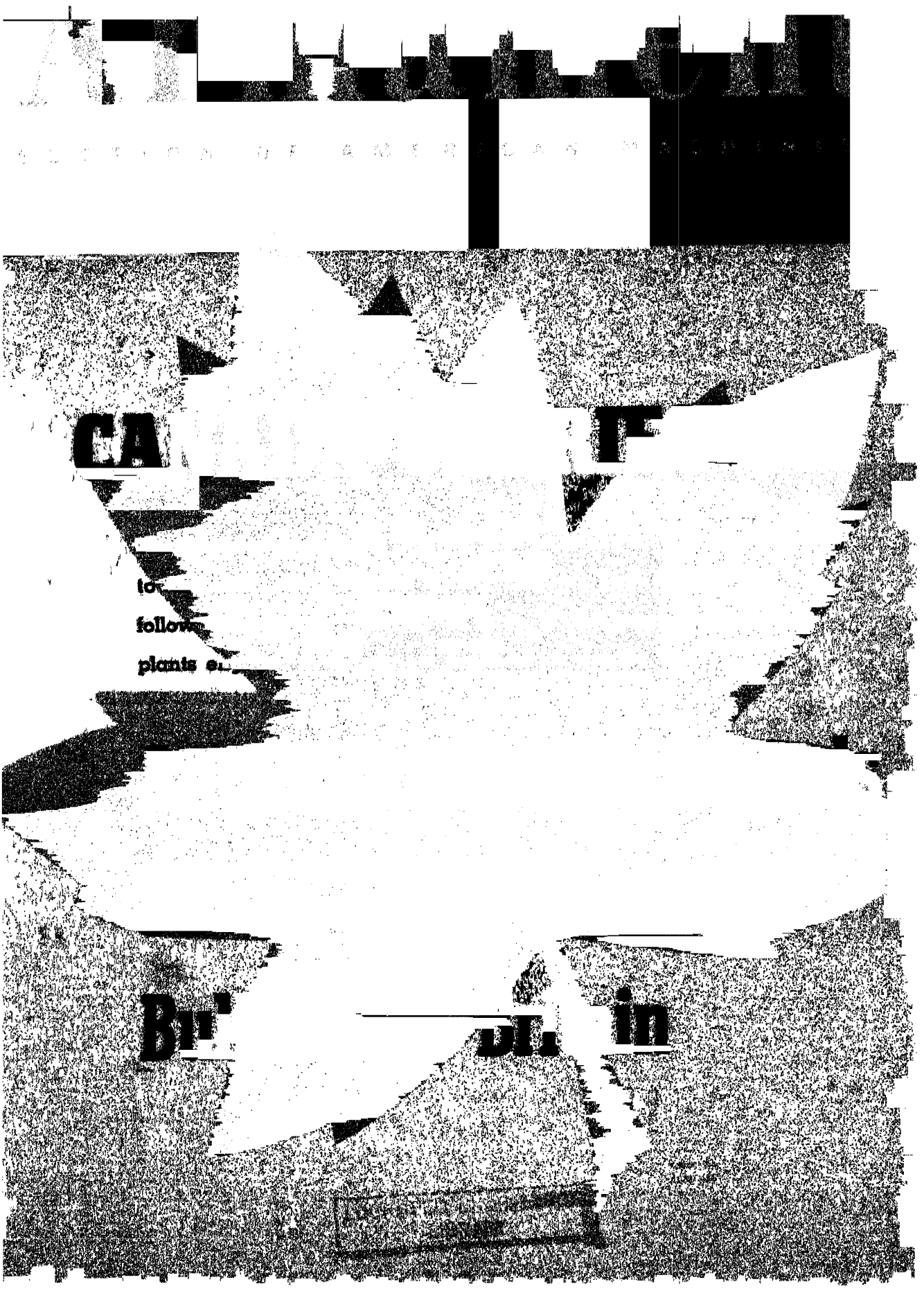
Although we were able to give a rotary motion to the spider, the space between the radial arms was not great enough to permit all the motion required for machining completely either the space between the arms or surfaces between the lugs on the outside of the casting However, by revolving the main bar *M* of its own axis which was done by loosening the bolts holding it to the shaper ram, by adjusting the over arm *N* and its brackets on the arm *M*, all the required positions were obtained When the ram extension *M* and over arm *N* are positioned properly for each cut, the combined reciprocating motion of the shaper and circular motion of the feed attachment finishes the stem surfaces *C* between the arms and the surfaces *D* between the lugs on the outside diameter While the cost of the fixture was rather high, it was more than offset by the results obtained

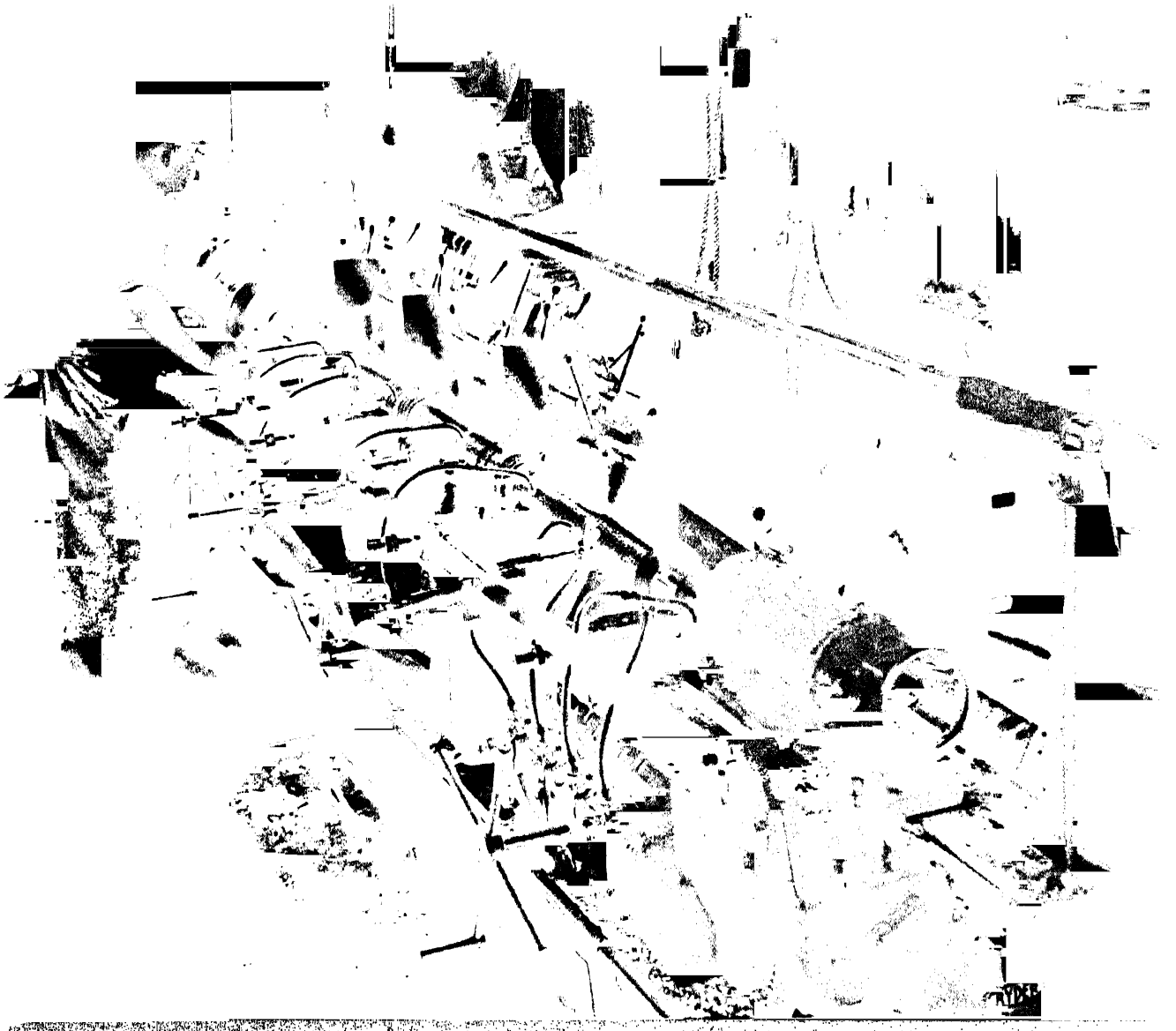
Combinations Produce Missing Gage Block Sizes

By M IACKER

Not all Johansson gage blocks can produce decimal sizes to thousandths and ten thousandths inches, for example, the No 2-A set of 31 blocks fails to produce quite a number of combinations in thousandths of an inch since the set does not contain gages for 0 001 in up to 0 009 in Consequently, as one example, 0 181 in cannot be obtained

However, it can be found within 0 0004 in by simply adding some gage block dimension in the set to 0 181 in , as for instance 0 101 in to obtain 0 101 + 0 181 in or 0 282 in , and then set the micrometer to the latter dimension Then place the 0 101 in gage on the anvil of the micrometer and caliper or fit a piece in the remaining space which will be 0 181 in Similar combinations will give the missing sizes





The breech end, the adjacent parallel section and the taper are rough and semi-finish turned in two set-ups on a "Lo-Swing" lathe. Combining operations saves time, affords better concentricity of the various surfaces

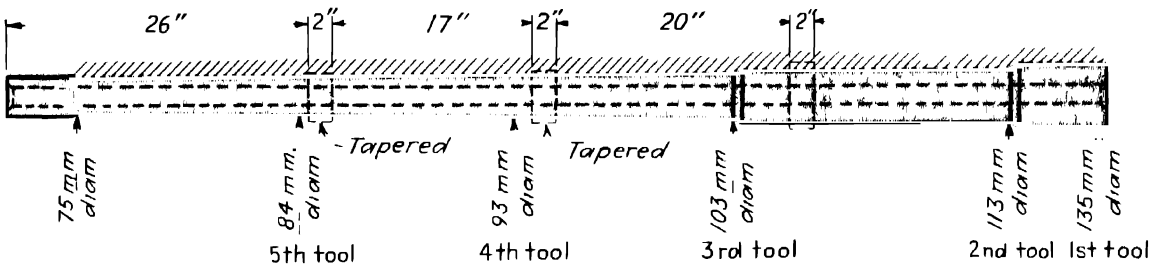
ANTI-AIRCRAFT GUN BARRELS

EARLY IN JULY a Canadian plant with no previous experience in manufacturing cannon got under way upon a large British contract for Bofors anti-aircraft gun barrels. Fourteen weeks later the first barrel passed inspection. October, the fourth month of production, witnessed completion of a sizable quota on time. The quota for November was twice that for the previous month, but it was finished several days in advance. Further lifts in production await delivery of much-needed American machine tools.

This record is made more remarkable by the fact that the shop started with 70 per cent unskilled labor. Technical school boys were chiefly selected for training under the direction of the few skilled men available. Gun making can be likened to "production

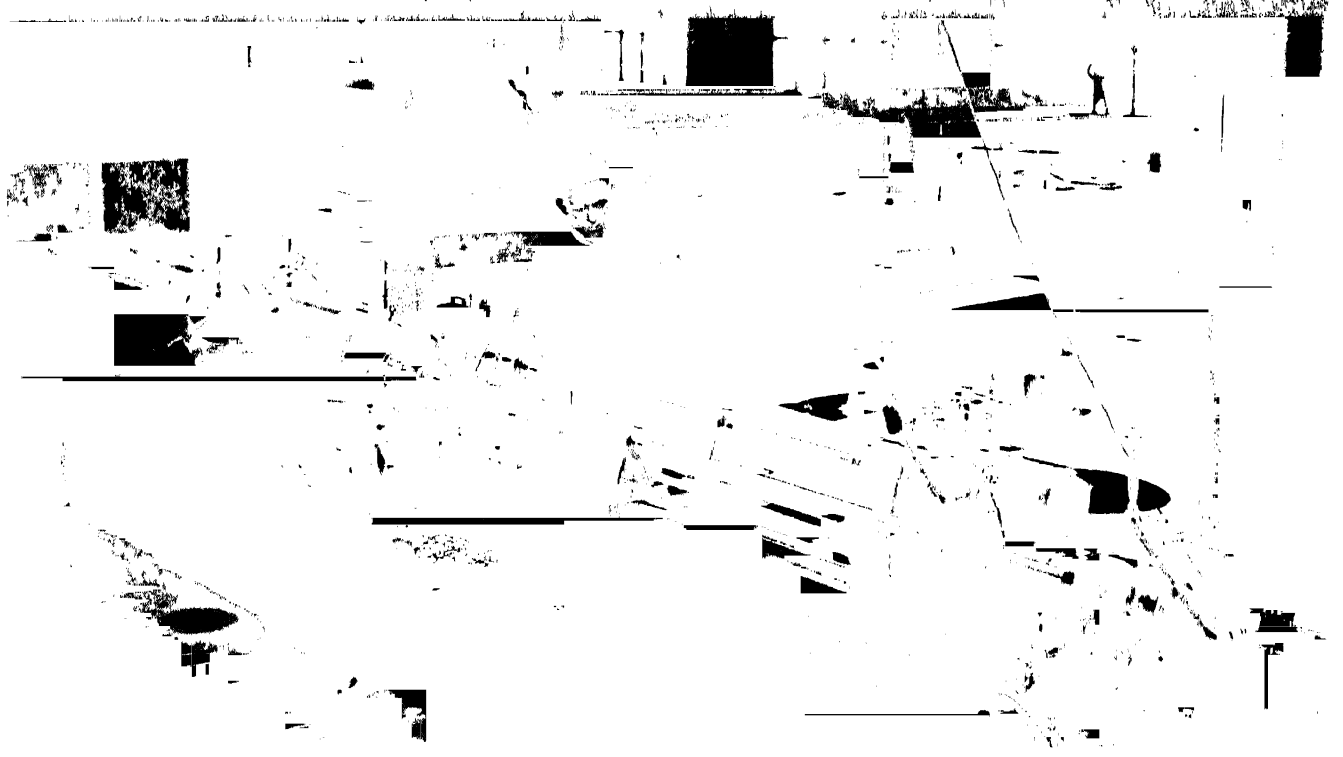
toolmaking." As the shop superintendent expressed it, "the boys do not know what a tenth or better is, so they go ahead and work to it." Of course, each machine set-up and its tooling were carefully worked out in advance to achieve and maintain accuracy at each step The boys are drilled in the routine of a given set-up under the direction of a skilled man, after which the operator imparts job knowledge to one or two learners, before being rotated to other jobs At present, the training program on the primary operations has grown to the point where some boys have been transferred to the domestic-goods machine shop, until such time as additional equipment is received

The production sequence for the barrel has undergone several changes since the original plan was laid down in late 1939 The number of turning operations upon the barrel, for example has been cut down To minimize error, well-supported roughing and semi-finishing cuts on the parallel and tapered sections of the barrel are handled in two set-ups on a multi-cut lathe instead of taking several light cuts here and there on engine lathes A milling machine does all six operations on the breech end in one set up in order to hold the

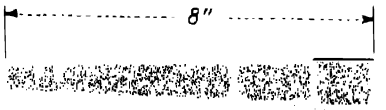


To support the barrel properly in the Lo-Swing, three roller tracks are turned by auxiliary toolslides before the roughing or the semi-finish turning operations

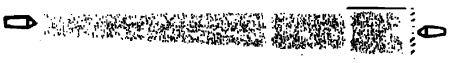
Deep drilling of the barrel is carried out on a Pratt & Whitney duplex machine. Muzzle end of the barrel is held in a tapered bushing and the drill bar is guided by a long bushing



HOW TO MACHINE BOFORS GUN BARRELS



Forging



Oper. 1 – Center ends. Oper. 2 – Face B.E.

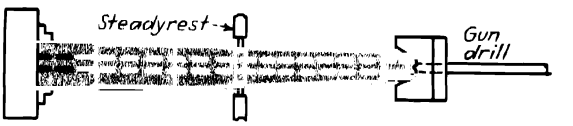


Oper. 3 – Turn O.D., leaving 8 mm., and spot

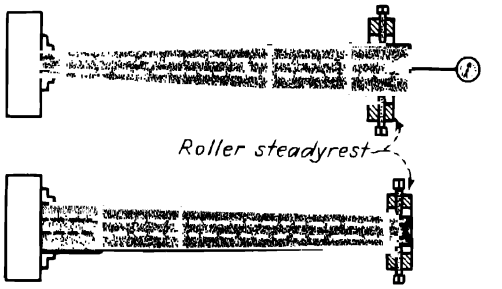
Preliminary operations on the barrel forging are designed to throw error from the drilled hole to the rough-turned O.D.



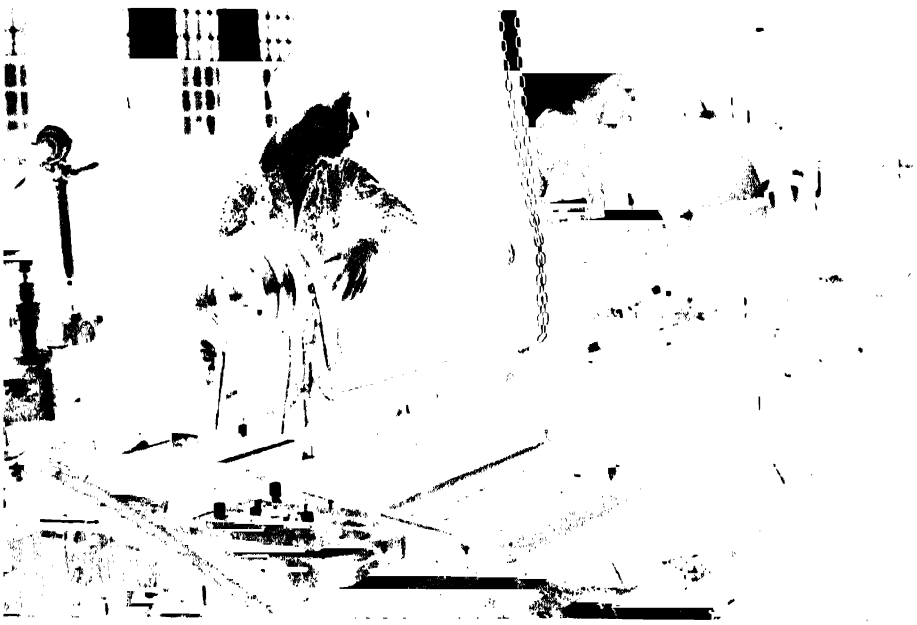
Oper. 4 – Turn M.E. to fit boring machine bushing and spot steadyrest track



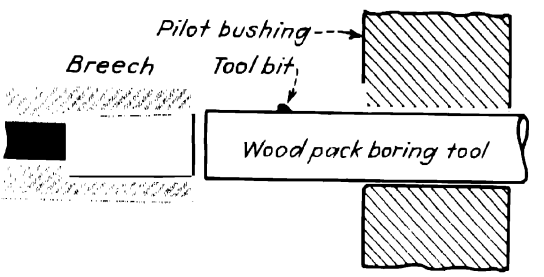
Oper. 5 – Drill to 1.42 in (Duplex)



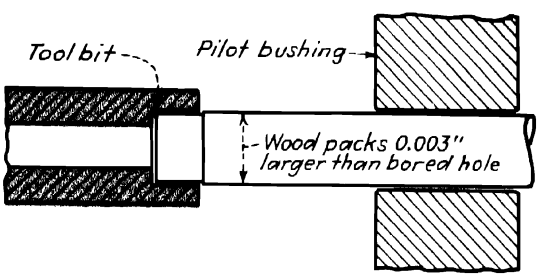
Oper. 6 & 7 – Cone breech end and muzzle end



Operations like coning and chambering, wherein the hole must be set up to run dead true at both ends, are performed on heavy engine lathes fitted with roller steadyrests. The end at the faceplate is caused to run true by means of an indicator bearing on an external test spot, while the opposite end is set true by an indicator contacting the hole periphery.



Inaccurate Boring Set-up. If pilot boring is not "dead true," the boring tool will not correct the misalignment but will follow the pilot hole



Correct Boring Method. The boring tool cuts its own start, and the oversize woodpacks are shaved to size by the newly cut edge of the hole

vital surfaces in correct relationship with the datum line. By and large, the production sequence is fully established, but one or two operations may be changed in order to speed up output. An example is broaching the rifling instead of draw cutting with a single-point tool.

A Bofors gun barrel is not an easy piece to machine. Forgings are supplied in the heat-treated condition, and show an average hardness of 300 Brinell. The material is a nickel-chromium-molybdenum steel of 0.25-0.35 carbon and possesses a yield point of 45 British tons. Machining speeds and feeds are not set at the maximum for two reasons: (1) it is considered better practice to take a 1/16-in. cut at fine feed where a ⅛-in. cut with heavier feed might be thought possible, in order to maintain the desired accuracy and not set up strains in the forging, and (2) primary operations need not be run at the highest feasible speed until operators achieve greater skill, because there is no need to pile up several hundred gun barrels ahead of the finishing operations, where the bottlenecks exist. This policy has reduced scrap to an extremely low figure, while quotas have always been met or exceeded.

Seven primary operations are needed to convert the forging into a rough-turned and drilled barrel, with the hole established as the locating point for subsequent semi-finishing operations leading to boring. The first and second operations consist of centering the forging and facing the breech end, respectively. Facing the breech is done to provide a new surface for the forging heat number and barrel number, which must be transferred from the mid-section prior to rough turning.

Operation 3 involves rough-turning in two stages upon a "Lo-Swing" lathe. Before either cut is taken, three small steadyrest spots are turned on the barrel by means of three small auxiliary toolslides and three small steadyrests. After the spots are turned, the main steadyrest rolls are positioned on the spots and the main tool slides are advanced to machine the breech section, the adjacent parallel section and the long taper to the muzzle end. Two tools work on the tapered portion. From 3/16–⅜ in. of metal is removed, the work speed being 25 r.p.m. and the feed 0.013 in. The second cut removes another ⅛ in. of metal and brings the piece to within 8.0 mm. of final size. The feed remains at 0.013 in. for the second roughing cut, but the work speed is increased to 45 r.p.m. Total time for the operation amounts to 170 min. High-speed steel tools are satisfactory for this operation. They are ground to special gages because the tools actually lie above center and must be ground to cut at the center of the work.

In Operation 4, the muzzle end of the barrel is turned to 83 mm. diameter in an engine lathe, to fit the bushing in the Pratt & Whitney duplex deep-hole drilling machine. A steadyrest spot is also turned at the center for subsequent use on the deep drill.

For deep-hole drilling, Operation 5, the work is indicated and securely chucked at the breech end, the central turned spot is supported by a steadyrest and the muzzle end fits snugly into a free-running bushing that is slightly tapered internally. The special Pratt & Whitney single-lip drill bit is keyed and pinned to the bar which does not rotate, but which is fed through the muzzle bushing and into the work at 0.0011 in. feed per revolution. Work speed is 142 r.p.m. Sulphur-base oil is fed through the hollow bar and drill bit at a pressure of 175 lb. per sq. in. to clear out the chips. The drill bit is reground after each barrel, being set up for that purpose in a home-made fixture, with a step cam ground to the form of the drill-bit contour.

In a length of 8 ft. the hole is bound to deviate two or three thousandths from the barrel axis at the far end, and therefore no reliance is placed on the hole for further locating purposes. Hence, the barrel is coned in Operations 6 and 7. For coning, the breech or the muzzle end is chucked as the case may be, and the turned spot on the opposite end is inserted in a steadyrest. By means of four adjusting screws and an indicator, the run-out of the hole is set to zero all around the periphery. The hole is then coned by means of the lathe's compound rest. The piece is reversed and the operations are carried out on the opposite end. By this means, any error is thrown to the outside of the piece, where it

can be eliminated in succeeding operations.

To true up the external surfaces of the barrel, prior to boring the hole, two operations must be performed. In Operation 8, the barrel is again placed in the Lo-Swing for semi-finish turning to within 3 mm. of final size. The same tools are used as in the roughing operation, but the tool slides are set in to the new dimension. Steadyrest spots are turned by means of the auxiliary tool slides and steadyrests prior to the semi-finish turning operation.

Three locating surfaces for the boring set-up are machined on an engine lathe in Operation 9. The muzzle end is turned to 80.11 mm. diameter to fit the bushing in the boring machine, a central steadyrest spot is turned, and the breech section is skimmed 3 in. from the breech-end shoulder to provide a test spot concentric with the hole. Checking and straightening follow in Operation 10. Usually barrels require no straightening because of the care taken in setting up and machining during prior operations.

Every effort must be made to bore out the drilled hole in a manner that will assure minimum eccentricity, a high finish and little if any deviation relative to the axis in a distance of approximately 8 ft. Pilot boring was first tried. A pilot hole was bored to a depth of approximately 4 in., the wood-packed boring tool inserted and the complete hole bored. If the pilot boring was not chucked dead true (an operation requiring a skilled operator), the hole at the opposite end might be 0.010 in. off center. Once pilot boring was done, the boring tool could not correct misalignment. Besides, the wood packs were subject to uneven wear from running in an eccentric hole, thus contributing to further misalignment of the hole at the opposite end.

To overcome these conditions, the long wood-packed boring tool now runs in an extended pilot bushing which holds the tool in correct alignment while it cuts its own start. The bushing I.D. accommodates wood packs 0.003 in. larger in diameter than the 1.550 in. hole being bored. After the single-point cutting tool enters the hole, the over-size packs are shaved down to the hole size by running against the sharp edge of the newly cut hole. With the hole started correctly and the wood packs fitting the hole accurately, boring should be nearly dead true unless hard spots are encountered or the wood packs wear non-uniformly. Thus, the opposite end of the hole ordinarily comes true with the part axis within 0.002–0.003 in.

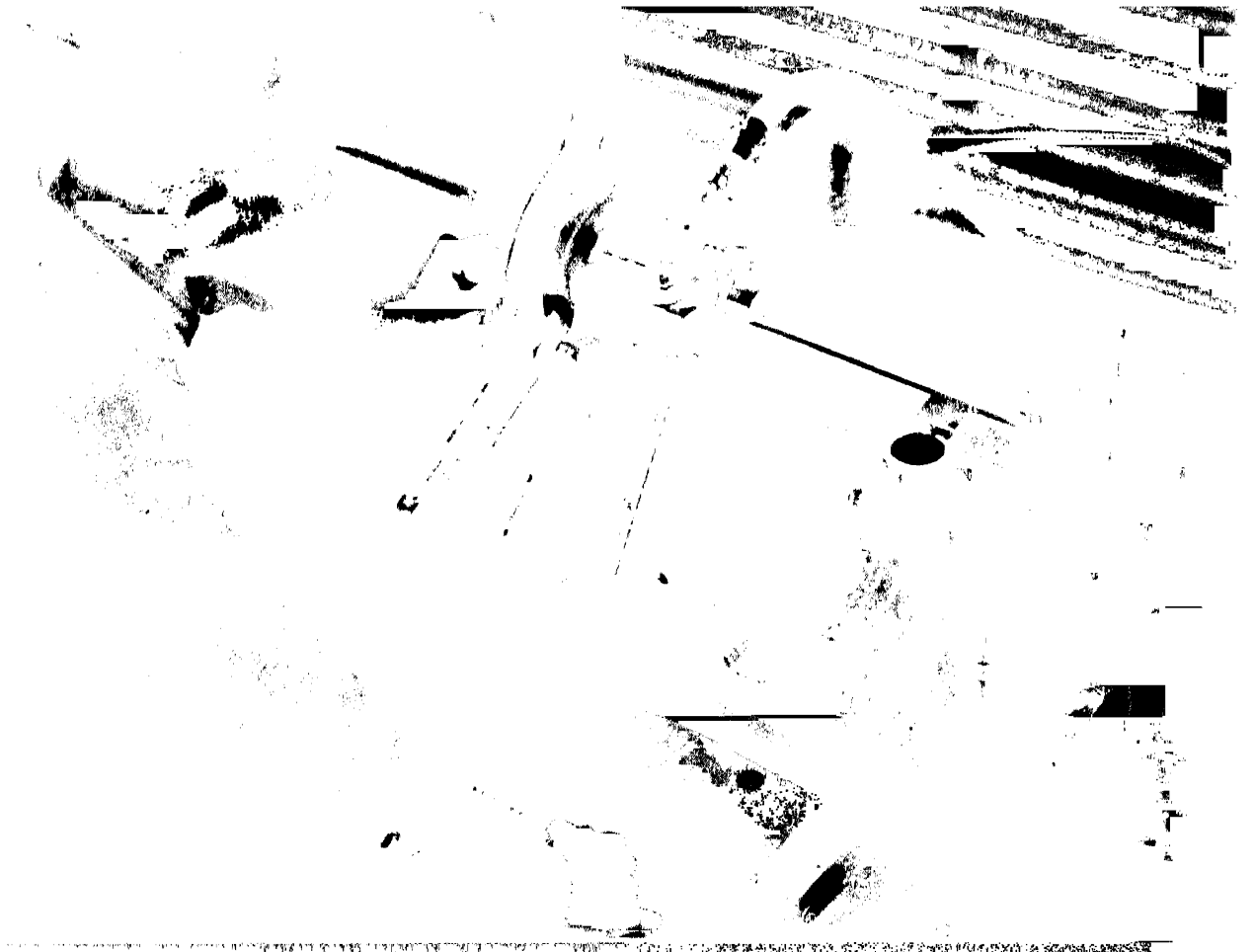
The feed per revolution is extremely small, since the work speed is 142 r.p.m. and the boring-bar feed (hydraulic) is set at ½ in. per min. The tool now used cuts on an extremely small radius, but may be superseded with a Davis-type arrangement. Total boring time averages about 3½ hours, floor-to-floor, some 20 min. being needed for set-up.

A second coning of the muzzle and breech ends of the barrel, Operations 12 and 13, throws any eccentricity remaining between the bore and O.D. surfaces to the outside of the barrel.

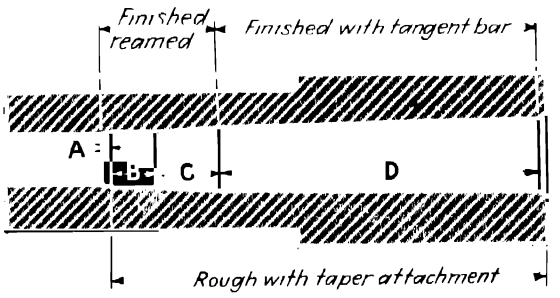
To speed up the finish-turning process, the parallel section adjacent to the breech is turned on one engine lathe, Operation 14, and the taper section is machined on a second engine lathe, Operation 15. In both set-ups it is required to finish turn the barrel to 0.5 mm. of final size, thus leaving about 0.020 in. for grinding. If necessary, the barrel is straightened during the checking process carried out in Operation 16. Only one barrel has been straightened so far.

Approximately 0.025 in. are removed from the bore by the honing process, which starts with the diameter of 1.550 in. and ends up with a 40-mm. hole, 0.01 mm. –0.00. This operation is carried out on a horizontal Barnes machine. If the barrel becomes too warm it is done in two stages; that is, all but the final couple of thousandths are removed and the barrel is set aside to cool thoroughly. The second honing brings the barrel to final dimension, and is easily done when necessary because setup time is not important. Total floor-to-floor time amounts to 2¾ hours. The honing tool is fitted with No. 38320 stones, I grade, and the stones last for approximately three barrels.

The parallel section and the taper are ground to size (0.020 in. being removed) in Operation 18. Grinding is a faster process than attempting to finish-turn to size, and



A tangent-bar fixture finish bores the long taper in the chamber. The tool-holder is contained within a dovetail slot in the tangent bar and is fed into the work by means of the pushrod fixed in the toolpost



Outline of chamber in Bofor santi-aircraft gun Tapers *B*, C and *D* are rough bored in one set-up. Taper *D* is finish bored with the tangent bar. Taper reamers are used after finish boring to cut taper *A* in order to blend taper *B* with the honed bore and to finish tapers *B* and *C*

Prior to boring, test spots and locating surfaces are turned on the semi-finish turned barrel in order to set up the hole so that it runs dead true at each end

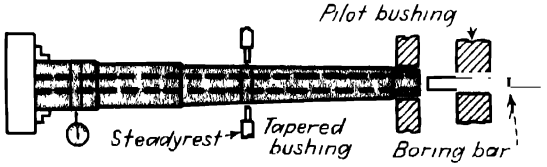
INTERMEDIATE OPERATIONS



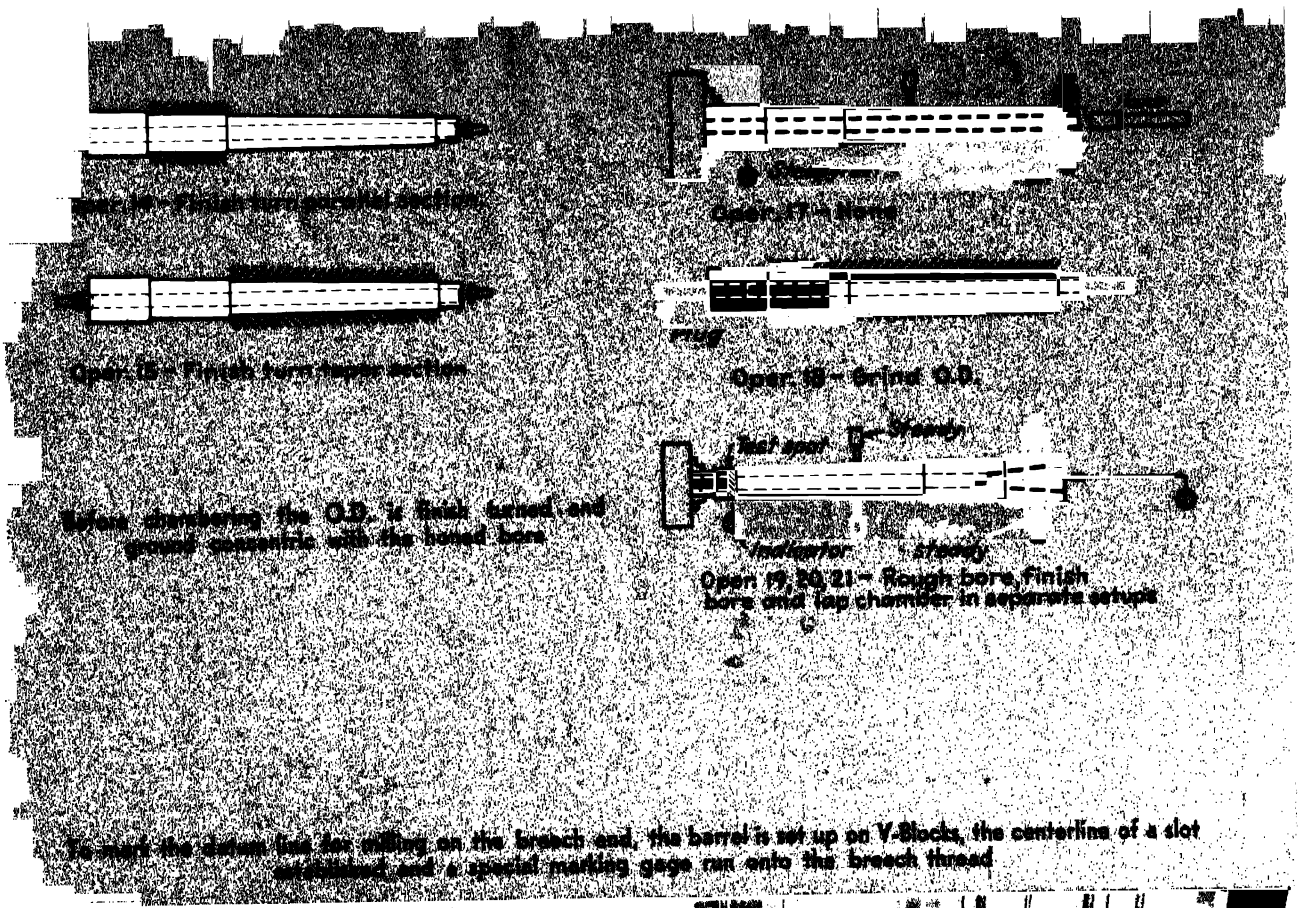
Oper 8 - Semi finish straight and taper sections and steadyrest spot



Oper 9 - Turn muzzle end, turn test spot and skim breech end shoulder



Oper. 11 - Boring



Oper. 16 – Finish turn gun-metal section.

Oper. 17 – Bore.

Oper. 18 – Finish turn nipple section.

Oper. 19 – Grind O.D.

Before chambering the O.D. is finish turned and ground concentric with the honed bore

Oper. 19, 20, 21 – Rough bore, finish bore and lap chamber in separate setups

To align the datum line for milling on the breech end, the barrel is set up on V-Blocks, the centerline of a slot established, and a special marking gage run onto the breech thread

besides the resulting surface is free of tool marks that might promote cracks during firing. It is essential to grind the parallel section to 109.04 mm. diameter to fit the collet in the milling fixture employed during operations on the breech face.

The process of chambering is the most vital operation in the gun maker's manual, but it is also the slowest, and most difficult. Reasons: (1) the chamber must be dead true with the axis of the bore, (2) all tapers must be smoothly blended and a mirror finish is essential, (3) the chamber must show a 100 per cent bearing with the master plug gage.

The present chambering process involves three steps: (1) "rough boring" three tapers, a process that requires an average of two hours, (2) finish boring and reaming on a second lathe, a step that consumes six hours now but took longer while operators were being broken in, and (3) lapping with fine abrasive cloth on a third lathe, a process that is indeterminate in respect to time consumed. Three barrels may be lapped in five hours or one barrel may take three hours or longer.

Rough boring the chamber, Operation 19, is done on a Bertram engine lathe modified in the following manner: (1) a special tool block was fitted to the compound rest and bored in place to receive the boring bar after the compound rest was doweled to its slide and the cross-slide was doweled to the carriage, and (2) the taper bar on the taper attachment was removed in favor of a special cam bar incorporating the tapers.

The muzzle end of the barrel is chucked on the straight-turned end section and indicated on the test spot, and the breech end of the hole is indicated dead true in a roller steadyrest. The indicator for the breech end has a long 1:1 pivot bar that contacts the honed bore beyond the chambering depth.

For finish boring, Operation 20, the rough-chambered barrel is transferred to a second Bertram lathe, which has a tangent bar attachment for guiding the finish-boring cutter. The tangent bar consists of a taper plug with a dovetail slot along one side for the toolholder and a bronze bushing that supports the free end of the bar in the honed hole. The other end of the bar is rigidly supported in a heavy bracket that can be clamped securely to the machine ways.

The first step in finish boring is to secure an accurate set-up of the barrel so that its bore runs dead true. This is accomplished by indicating the test spot at the muzzle end and setting the bore dead true at the breech end by means of a tell-tale indicator reaching beyond the rough chamber. Second step is to position the tangent bar attachment so that its axis coincides with the hole axis, and so that the depth of insertion is a definite amount. Third step is to slide the dovetail toolholder containing a 5/16-in. bit into the tangent-bar slot and connect the free end with a push rod fixed in the turret. After all elements of the set-up are completed, a laborious and exacting procedure, the long taper is finish bored ready for lapping. Depth of boring is controlled by the turret indicator, which contacts the finished face of the tangent-bar bracket. Finish boring removes 0.0075 in. per side of hole. When tested with a plug gage, the long taper must show a 100 per cent bearing and its surface must be free of rough tool marks and scratches.

During reaming, the roughing reamer removes 0.005 in. from the two short tapers *B* and *C*, and cuts taper *A* to remove the ridge between the honed hole and taper *B*, as left by rough boring. Finishing reamers remove the final 0.002–0.0025 in. Reamed tapers must be free of tool marks and show 100 per cent bearing with plug gages.

British standard practice is used in checking the interior of the chamber. It consists of laying a thick strip of warmed gutta percha upon a hardwood wedge, inserting the whole into the chamber and driving in a second wedge, so that the gutta percha flows and makes an impression about 1½ in. on the arc by the full length of the chamber. Every tool mark and the condition of the blend or lack of it at taper junctions is clearly revealed on the gutta percha. This convenient test shows the operator what condition must be corrected prior to lapping.

For lapping the chamber, Operation 21, the barrel is transferred to a third engine lathe. Lapping is done with strips of abrasive cloth fixed to a hardwood stick approxi-

mately 4 ft. long. The stick is fulcrumed in the turret and the free end is weighted to apply light pressure to the lapping end. Gutta-percha impressions of the chamber are made periodically to check the degree of polish imparted by the lapping action. The final impression must be free of all tool marks and the tapers must blend smoothly.

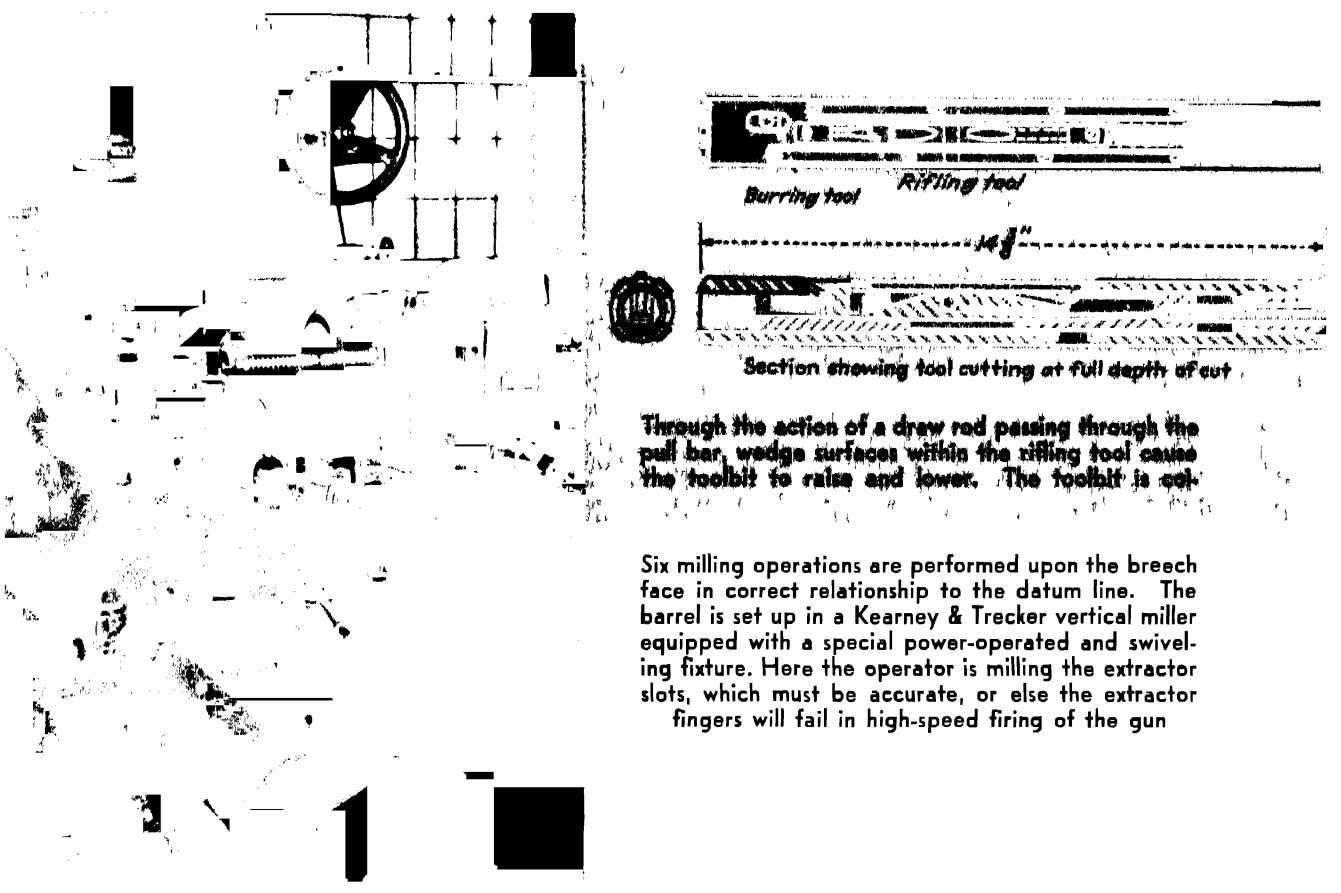
Several operations are required upon the exterior of the breech. These are combined on an engine lathe in Operation 22. The work involves turning the breech end to final diameter, facing the shoulder to length, grooving, peening a brass ring in the groove, turning the ring, and parting-off surplus metal from the breech face. Milling the buttress thread on the breech is done in Operation 23.

Rifling is at present done with a single-point tool, but this method may be superseded by broaching. The barrel is set up in a Le Blond rifling machine, which is provided with a fixture for cutting the long helical groove in the rifling bar. This operation is done initially when setting up the machine to a given rifling twist and need not be repeated until a new bar is required.

The rifling tool is of the draw-cut type and is fastened to the rifling bar. A draw rod passes through tool and bar and is connected to a geared feed wheel. When the rifling tool is pushed through the barrel, the draw rod collapses the toolbit below the rifling-tool O.D. in order to prevent scratching the bore. After indexing to the next cut and just as the draw cut begins, the toolbit is raised out to the set cutting depth by the action of the draw rod. The feed can be increased in small increments because a 3 in. graduated sector on the feed wheel represents 0.001 in.

Rifling is a time-consuming process because of the number of cuts involved. Sixteen grooves 0.022 in. deep must be machined around the periphery of the bore, but each cut amounts to not more than 0.0015 in. for the first 0.020 in. in depth. Previously, more shallow cuts were taken. Since the rifling is 0.022 in. deep, several finishing passes are required after the roughing cuts have reached the 0.020 in. depth. One part of lard oil to four parts of kerosene is used as a cutting compound. A brush fixed to the end of the rifling tool acts to clear stray chips.

Before the end face of the breech can be milled, it is necessary to set up the barrel



Through the action of a draw rod passing through the pull bar, wedge surfaces within the rifling tool cause the toolbit to raise and lower. The toolbit is col-

Six milling operations are performed upon the breech face in correct relationship to the datum line. The barrel is set up in a Kearney & Trecker vertical miller equipped with a special power-operated and swiveling fixture. Here the operator is milling the extractor slots, which must be accurate, or else the extractor fingers will fail in high-speed firing of the gun

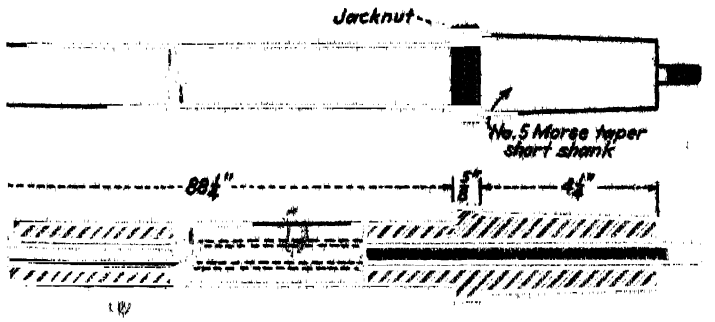
upon a surface plate and indicate the centerline at each end within 0.001 in. The centerline is indicated in relationship to a cross slot milled in the breech end-face during thread milling, and a special thread gage is applied to scribe a datum line in relation to the start of the milled thread. Milling and datum lines are marked in Operation 24.

Six cuts involving angular slots and a cam face must be milled in one set-up to assure accurate relationships. A Kearney & Trecker vertical miller fitted with a special pivoted power-driven fixture is chosen for this purpose, which is known as Operation 25. The barrel is held on the ground parallel section by the fixture collet and the outer end is raised to the horizontal centerline by means of a tapered bushing resting on a special stand. A steadyrest is also applied to hold the center.

All milling operations are performed in correct angular relationship to the datum line. The barrel is rotated by means of a graduated collar and two central locating slots are milled. One of these is 12 mm. wide and at a certain angle to the breech face, the fixture being pivoted to the correct angle with respect to the machine bed. The second slot is milled at a steeper angle, and is wider. After these cuts, the piece is rotated 180 deg., and the extractor slots are milled. These are spaced a definite distance above and below the horizontal centerline of the piece in the established position. Part of each extractor slot is at right angles to the bore, and the remainder at an angle.

The milled cam face around the periphery of the breech end is obtained by rotary power feed of the fixture head through a telescopic drive from the low-lead gearbox. As a final operation, a slight taper is milled around the breech behind the thread.

Relatively minor operations are needed to complete the barrel. Interruptions in the thread are shaped in Operation 27. Five operations are combined on an engine lathe, being grouped in Operation 28. These consist of turning center steps, cutting the center thread, turning and threading the muzzle end for the flame guard and parting off excess stock on the muzzle. Five fitting, sub-assembly, drilling, parkerizing and final assembly operations bring the grand total of operations upon the barrel to thirty-three. Barrels are shipped elsewhere for proof testing.



lapsed into the body of the tool while pushing it through the bore for the next stroke and is raised to feed depth by the draw rod at the commencement of the return stroke for the draw out



Minor fitting operations are necessary upon the breech before final assembly

3.7 IN. SHELL FORGINGS

SINCE 1936, a Canadian plant has been making shell for the British Government, first on an experimental basis and now in mass production. One of the shell currently produced is the 3.7-in. high-explosive type. In many ways this shell is similar to the American 75-mm. high-explosive model, except that the base is thicker in order to permit machining a recess for the baseplate cover. Forging is of interest now that United States plants are setting up to produce artillery ammunition, because the method employed is a proved proposition, as indicated by a net production of 100 shell forgings per hour per forging unit.

The Stewart-Lloyd shell-forging process is a two-step method that involves: (1) producing the "bottle" by piercing a square billet, and (2) finishing the shell forging by drawing the bottle to correct diameter in rolls. Several advantages are obtained by doing the work in two stages: (1) the hole is accurately centered in the shell, and internal diameter and finish are such that no machining need be done, (2) the base thickness is held to 2.0 in. in *both* operations, which is essential for later machining, (3) there is minimum scrap loss in trimming, (4) loss from imperfect forgings is practically nil, and (5) piercing punches and drawing mandrels give maximum service between dressings.

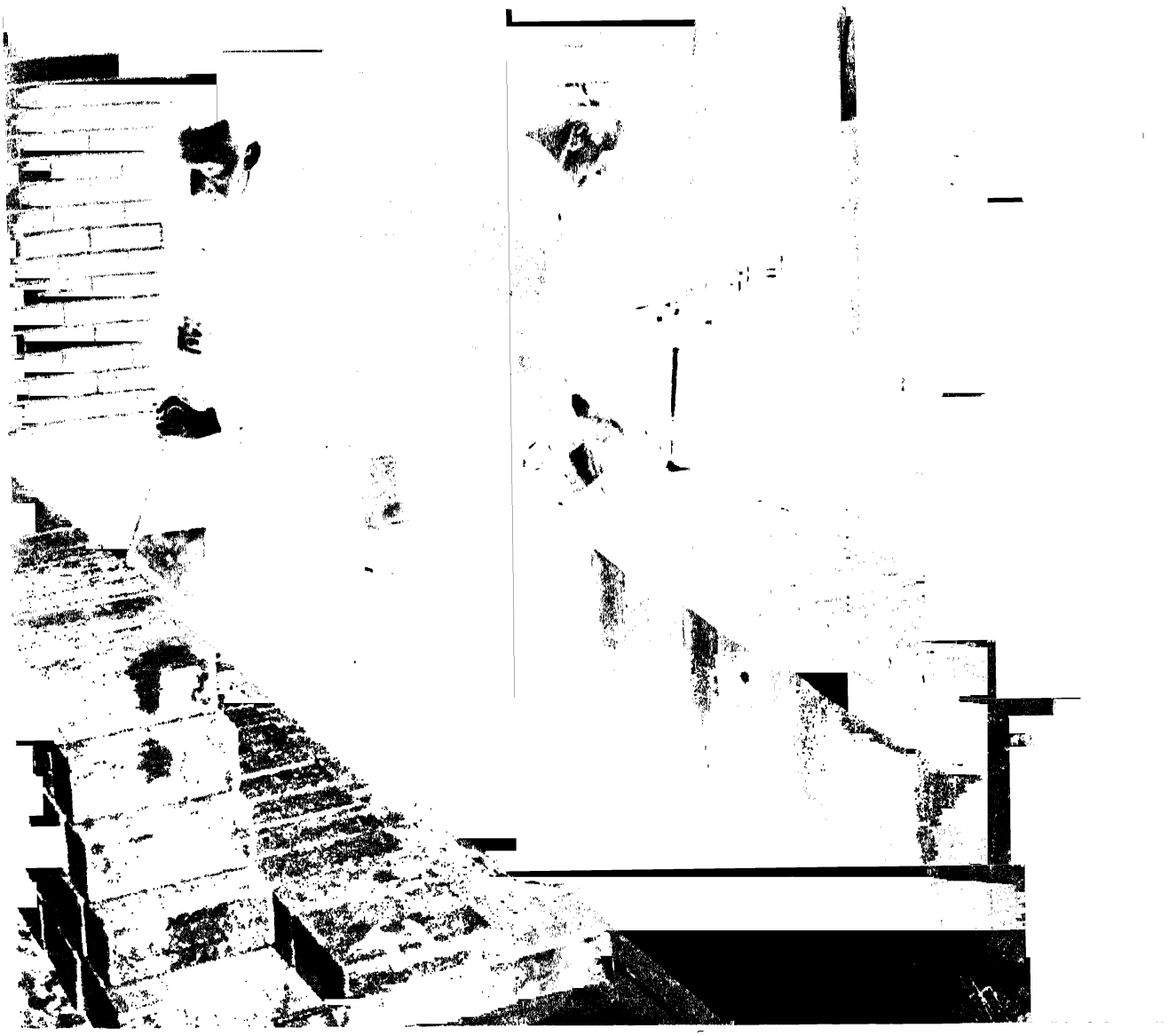
Shell steel is purchased in the form of $3\frac{3}{4}$ in. square bars with the edges beveled to fit the pot in the piercing die. These beveled edges also provide a four-point bearing of the billet against the wall of the die pot, so that the blank can not get out of center with the piercing punch. The punch merely opens the material out to fill the die-pot cavity. The steel analysis must conform with the British War Department's specification for a material that requires no heat-treating and will fragment properly upon bursting. In general, the material analyzes at 0.52 carbon and 0.80 manganese and possesses a yield point of 44,000 lb. per sq. in.

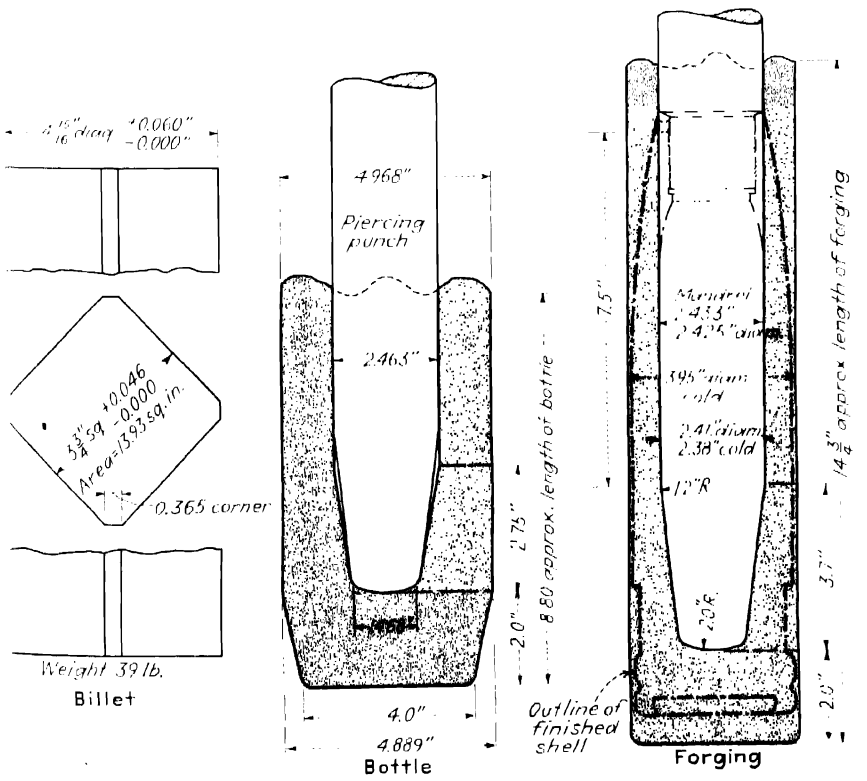
Bars are hot sawn at the steel mill to an exact number of multiples of the desired $9\frac{3}{4}$ in. billet length, plus cutting-off allowance. The maximum length handled in the special oxy-acetylene cutting-off machine is $100\frac{1}{2}$ in., which provides ten billets. But shorter lengths are accepted from the mills, providing they are cut to exact length for a definite number of pieces.

Bars are laid side by side upon the roller bed of the cutting table. They are gaged for length by the front gage bar, which parallels the structural steel track upon which the oxy-acetylene automatic cutting-off machine travels. Bars are also aligned against side rolls along one edge of the table. By the use of two gages, the bars are cut off dead square, which is essential in order to have the billet stand properly upon the piercing-die seat.

Two men operate each oxy-acetylene cutting-off machine. After the table is loaded and the cut begun, one operator precedes the machine with a hand torch to heat the beveled joints between bars. This is necessary to secure satisfactory operation of the automatic cutting-off flame without using special means to compensate for the notched effect in the work. The other operator stacks the cut billets, removes flash and stamps the identification. Production amounts to 54 billets per hour per machine, two units being necessary to keep step with each forging set-up.

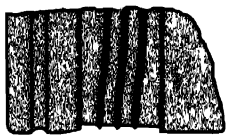
Billets are transferred to a rotary furnace, where they are placed on end in three concentric rows around the perimeter of the rotating ring that forms the hearth. Maximum allowable thermal head is 2192 F., and the billet temperature at discharge is approximately 2,080 F. There are three heat zones in the furnaces: heating, soaking and unloading. All zones have temperature accurately controlled by indicating and controlling pyrometers. Full arch construction is used in the furnace, with burners firing across the work rows from both sides and vented at the hearth level, with the vents carried up within the inner and outer walls. Between the loading and unloading doors there is an arch with



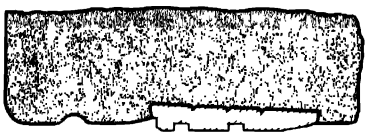


Billet cutting is handled by two men serving an automatic oxy-actylene cutting-off machine. One man preheats bar steel ahead of the machine torch the other stacks and chips the shell blanks, and stamps identification

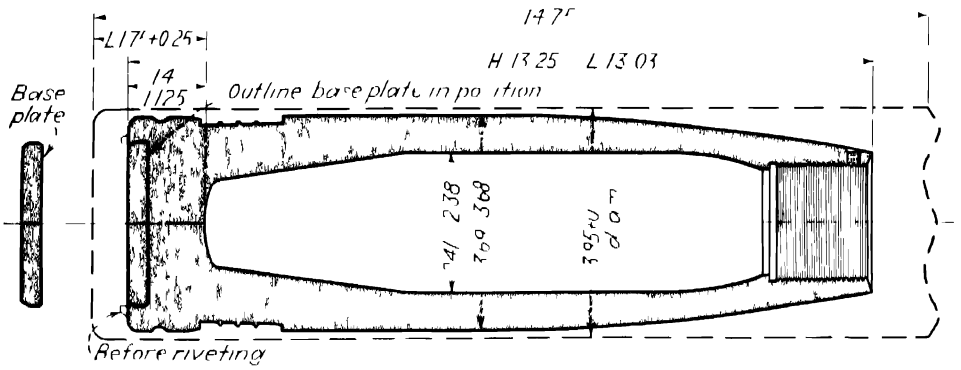
In the Stewart-Lloyd forging process, the shell is made in two steps: (a) piercing a square billet, (b) drawing the bottle so produced in rolls in order to reduce the diameter and draw out the length. Both operations must produce and maintain a 2-in. base thickness. Underlined dimensions are finished sizes and will not be subsequently machined. Dot and dash lines represent the outline of the machined shell. Thickness of the forging wall, due to the eccentricity of the cavity at any point, must not be less than 0.74 in., because the finished wall thickness must come within 0.62-0.67 in.



Detail of Band Seat

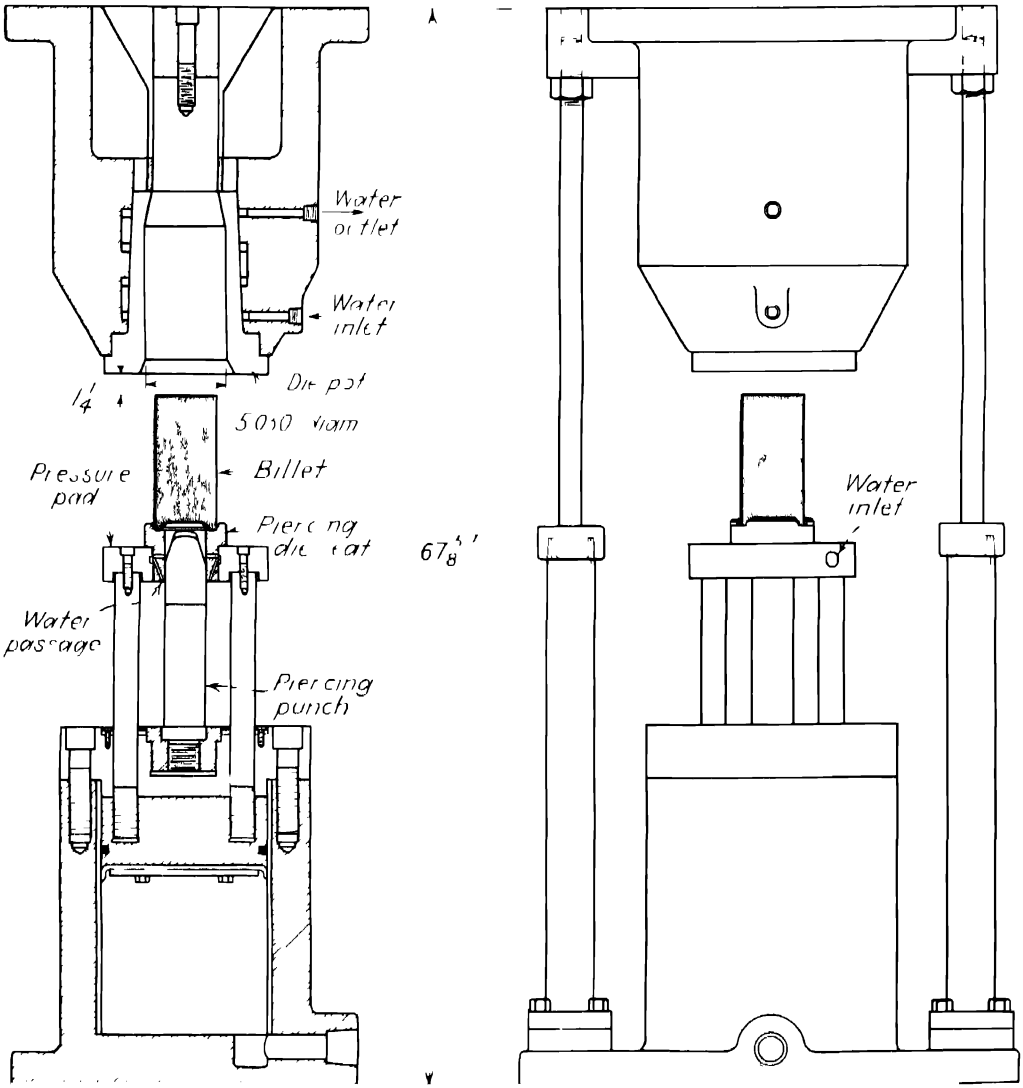


Driving Band-Copper



The forging for the British 3.7-in. shell differs from American high-explosive types chiefly in the thicker base, which provides metal for machining a recess and a riveting edge for the base-plate cover. American practice calls for a cover spot-welded to a thinner base

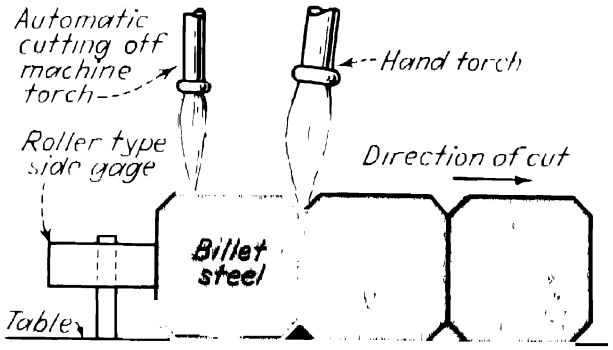
A centralized hole is assured by the "inverted" piercing method. Upon the down stroke, the die pot first engulfs the billet and the locating pad before striking the piston-supported pressure pad. As the pressure pad recedes, the die pot forces the billet over the stationary piercing punch, which is piloted by the locating pad



clearance beneath to allow billets standing on end to pass under. At the right of the unloading door there is a burner directing hot gases below the dividing arch to prevent newly charged billets from cooling the soaking zone.

Weight of each billet is 39 lb. Thus, with a net production of 100 billets per hour, 3,900 lb. of material are heated, although the furnace has a rated capacity of 5,000 lb. per hour. Consumption of 540 B.t.u. amounts to 338 cu. ft. of gas per 100 lb. of steel.

Three men are required to handle cold and hot billets. One man loads the furnace. A



A hand torch is used to preheat the billet steel ahead of the automatic machine, because the notched effect between bars would otherwise affect the efficiency of cutting off

helper removes the heated billet from the furnace and drops the piece upon a pallet. A second helper scrapes scale from the billet. Foot-operated air valves are conveniently placed to control the opening and closing of the loading and unloading doors of the furnace.

A vertical 350-ton four-column hydraulic press is employed for the piercing operation. Vertical die space is 63 in.; maximum stroke, 30 in., and right to left distance between columns, 26 in. Hydraulic line pressure is maintained at 1,700 lb. per sq. in. This pressure, plus a 3-in. valve upon the press itself, assures an ample supply of fluid at correct pressure to the cylinders which operate the upper and lower dies, respectively.

The upper die consists of an outer steel casting recessed internally for water-cooling the die pot. A floating stripper bar, moved by two side rods during the upstroke, causes a plunger to extract the forging from the die pot, from which point the pierced bottle drops to the locating pad for removal to the drawing press.

The bottom die consists of a hydraulic cylinder with the piston supporting four pressure pins. A circular pressure pad is mounted on top of the pins and carries a four-pronged locating pad. The pad is a sliding fit in the die pot, and also serves to guide the stationary piercing punch, which is threaded and seated in the cylinder head. Thus, the billet is accurately located in the die pot by its beveled edges, and the piercing punch is guided by the locating pad which has entered the die pot. Through this arrangement, the hole must come central in the forging. The concentricity maintained in piercing is extremely close, because the subsequent drawing operation reflects any inaccuracy which might occur if means were not provided for its prevention.

In operation, the billet is placed on the piercing-die seat, or locating pad. A proprietary oil is applied to the punch prior to the down stroke, although a mixture consisting of one part of graphite to five parts of quenching oil has been used as a lubricant. When the press is tripped, the upper die comes down and the billet is engulfed in the die pot. Continued travel of the upper die causes the pressure pad and pins to recede, although constant pressure is maintained in the lower cylinder. Upon the upstroke, the pressure pins and pad follow the upper die to strip the shell bottle from the piercing punch. Mention has been made of the means employed for removal of the forging from the die pot.

Three men are required to run the piercing press. One man operates the controls, a helper places the billet in the dies, and a second helper removes the forging and places it in a small gas-fired furnace for reheating. The furnace holds two shell. Reheating makes the material more plastic and thereby eases the strain on the drawing rolls used in the second operation.

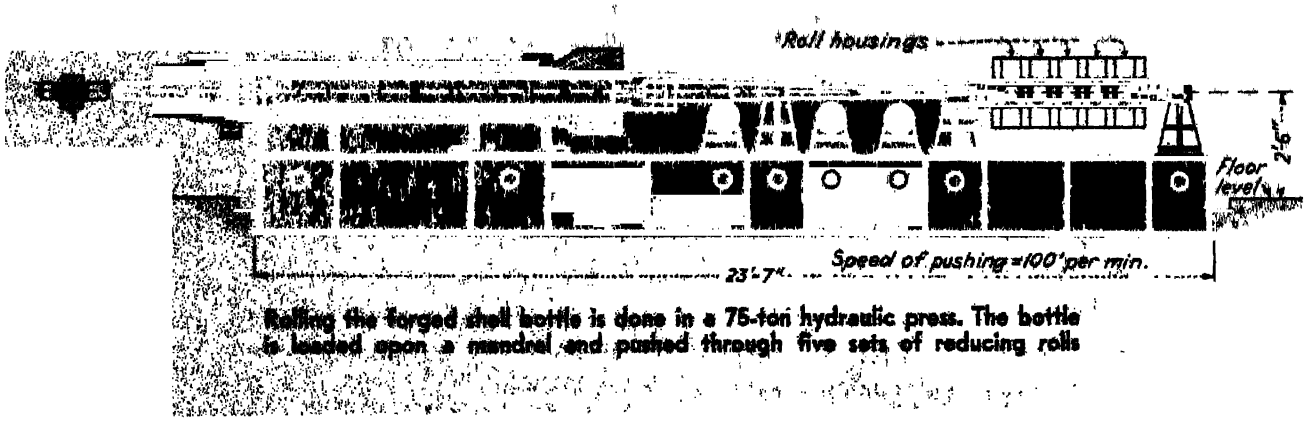
Shell forgings can be produced theoretically at the rate of four per minute by this set-up, but adequate time must be allowed for the piercing punch to cool, for changing the pierc-

ing punch or die pot when scored, and to allow the men to rest or change places with fresh operators. It must be remembered that these men are pulling 3,900 lb. of steel per hour out of a furnace or lifting it from the floor into the dies. Besides they must contend with heat and the long work week brought about by war conditions.

One of the most important factors limiting the speed of shell production is the danger of drawing the temper of the piercing punch if allowed to remain too long in contact with steel at nearly 2,080 F., or if insufficient time is given the punch to cool. Once the temper is drawn, the punch galls or scores and thereby affects the internal finish of the shell.

In the set-up described, the machine cycle requires 8 sec., during which the piercing punch is in contact with the metal for perhaps 4 sec. Upon completion of the upstroke, an auxiliary water jet is applied to the punch in addition to the water that flows through numerous small vents in the pressure pad. Circulating water surrounds the upper die liner, and flows continually. The hot metal parts are cooled so that they barely generate steam. Even so, satisfactory punch service between dressings amounts to only about 100 shells. Three dressings per punch afford the tool a life of about 300–400 forgings. Punch changes require from five to ten minutes, and are made practically once in every hour. The loss of time incidental to hot forging operations of this nature plus the exacting requirements for accuracy reduce the theoretical maximum output.

Naturally, a great deal of experimentation has been done and is being continued with materials for piercing punches. A hot die steel that has given as good service as any material tried to date has the following composition: 0.30 carbon, 0.30 manganese, 11.0 tungsten, 3.25 chromium and 0.40 vanadium. Heat-treatment consists of: annealing at 1550 F. for two hours per inch of thickness and cooling slowly in the furnace; preheating slowly to 1200 F. for two hours, then to 1500 F. for fifteen minutes, remove and cool in still air. Tempering is performed as follows: first draw in salt bath at 1300–1350 F. for two to three hours and cool to 300 F., second draw, 1150–1200 F. for two hours and cool in still air. Hardness obtained is 30–32 Rockwell C.



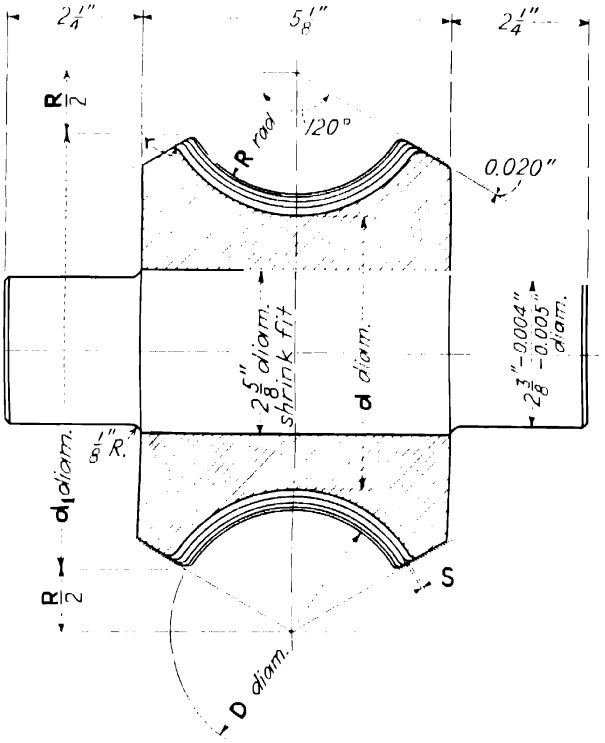
Rolling the forged shell bottle is done in a 75-ton hydraulic press. The bottle is loaded upon a mandrel and pushed through five sets of reducing rolls

Two purposes are accomplished during piercing: (1) the square billet is opened out to a diameter slightly in excess of the diagonal distance across the billet, and (2) the bottom is tapered to promote drawing the bottle to the diameter and length desired in the forging. The drawing operation on the 3.7-in. shell involves loading the bottle upon a mandrel that fits the pierced hole, and pushing the piece through five sets of reducing rolls. This operation is performed on a 50-ton horizontal hydraulic press, which has a maximum stroke of 75 in.

The pierced billet is laid in a V-block in front of the roll housings, and a control valve is tripped to advance the mandrel. This tool is approximately 0.030 in. smaller in diameter than the piercing punch, because the billet



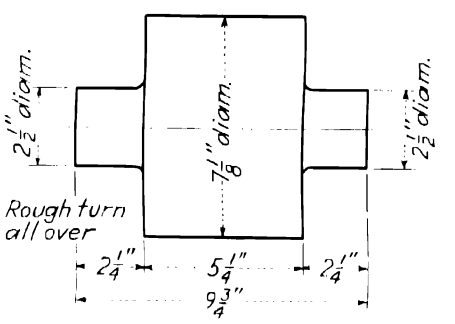
Spare roll housings and redressed rolls are kept in the tool room.
Maintenance of the bronze roll bushings is the chief problem



Roll Dimensions in Inches

Part No.	D	R	
1	4.6277	2.3138"	1.1569
2	4.3439		
3	4.190212.0961		
4	41...		
5	4.0027		

When roll is to be made in one piece Order roll blank to these dimensions



Rolls ordinarily last for 25,000 shell before redressing. The greatest reduction is done in the first three stages, and consequently the finishing rolls can be reclaimed for the "breakdown" stages

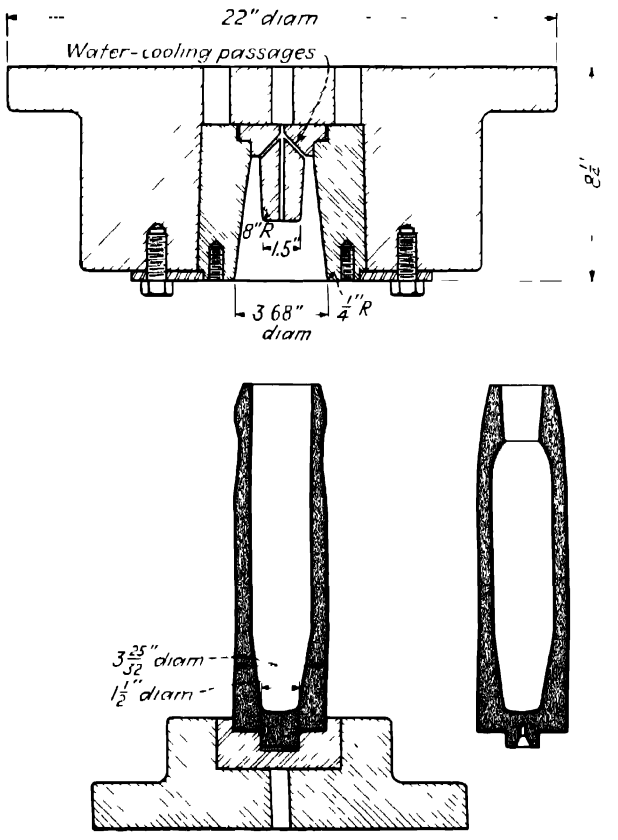
temperature has dropped somewhat. After the mandrel bottoms in the shell cavity, it carries the piece through the five sets of reducing rolls at constant speed. Upon emergence from the last set of rolls, the stroke is automatically arrested and two spring-actuated strippers drop against the mandrel behind the open end of the forging. When the return stroke takes place automatically, the shell is stripped from the mandrel and drops into an apron, whence it is removed for stamping and transfer to a sand bed for cooling.

By reducing the shell bottle in a sufficient number of stages (five in the case of the 3.7-in. shell) the thickness of the shell base is not disturbed. Experience shows that by starting with a properly centered pierced hole, the concentricity of the internal and external diameters is not altered in the drawing operation.

Each steel roll housing incorporates three radially arranged rollers, which are mounted in bronze bushings. Rollers may or may not be integral with their arbors, but they are not permitted to float. Alignment of housings in respect to each other is attained by clamping them upon round guide bars in the machine.

Rollers are produced from heat-treated steel with the following analysis: 0.55 carbon, 0.55 manganese, 0.75 chromium, 1.60 nickel, and 0.75 molybdenum. One set of rolls will produce 25,000 pieces. Journal bushings require more maintenance than rolls, hence spare roll housings are kept in the toolroom. Incidentally, draw rings have been tried for shell forging operations, but do not give as long life as rollers.

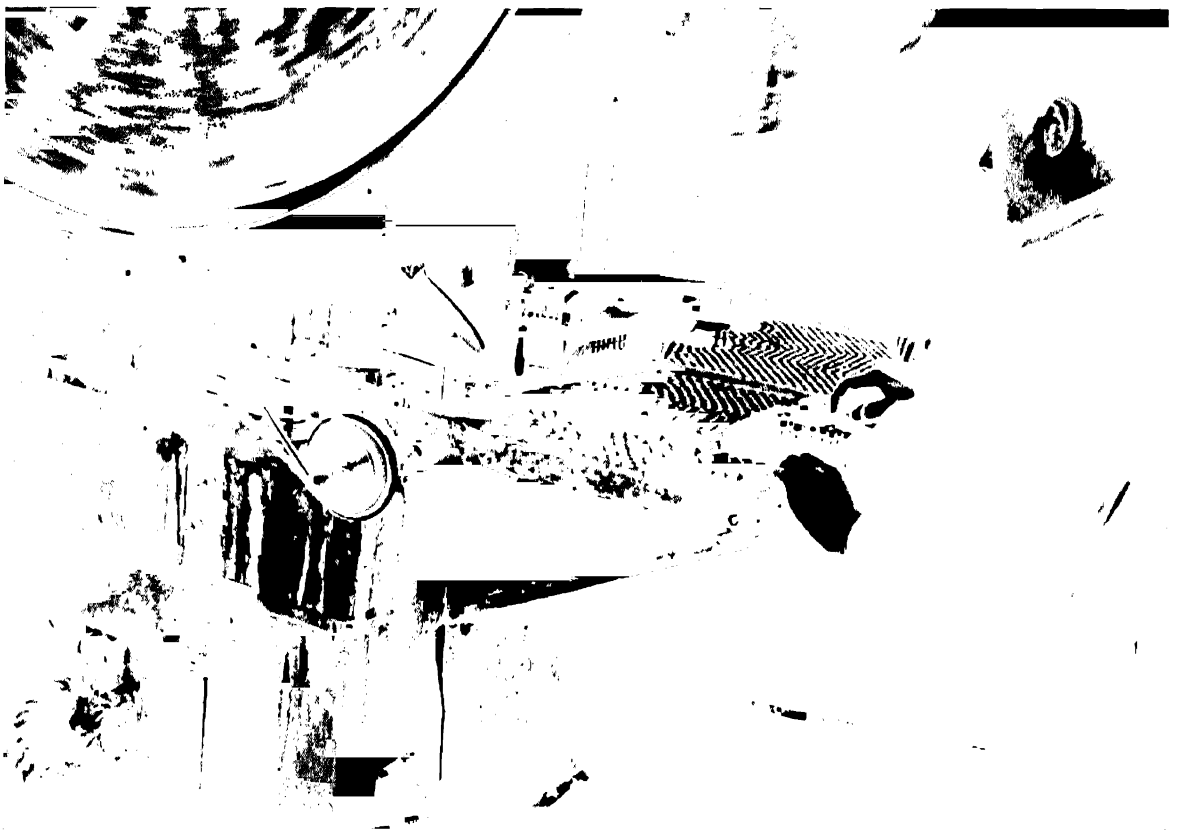
The finishing mandrel, or tip, is not put to the severe service encountered by the piercing punch, and hence has a life of about 1,500 shell between dressings. The mandrel is made of the same material as the piercing punch and is heat-treated in the same way. Proper lubrication and cooling are important. Prior to the forward stroke of the mandrel, it is swabbed with a mixture of one part graphite to five parts quenching oil. Upon completion of the return stroke, a ring water jet and a hose in the hands of the operator reduce the temperature of the mandrel so that it barely generates steam. The hot forgings are closely stacked on end in a sand bed so that they do not dissipate heat too rapidly, and hence practically normalize themselves.



Nosing is done hot after rough turning the O.D. contour and facing the ends. Only the nose of the shell is heated to 1830 F. in a porthole-type gas-fired box furnace before nosing in a 115-ton single-acting four column hydraulic press

BULLETS FOR BRITAIN

The Dominion Arsenal steps into the breach as a quick source of ammunition while other facilities are building



The first drawing operation on the cartridge case is done in a vertical press. The brass cups which have already been formed from sheet stock are carried into the machine by means of an automatic dial feed driven by the belt at the left

CANADA'S ARSENALS, like those of the United States, are designed to keep the art of munitions making alive during times of peace. As in the case of other countries, Canadian appropriations for national defense reached a low ebb during the pacific 20's and during the first years of the depression when economy was the watchword and governmental expenditures were cut to the bone. It is said that during this period one member of the Canadian Parliament proposed that the year's expenditure for defense items be limited to $1. Such drastic curtailment of course was never approved, but the mere fact that it was seriously considered reflects the extreme reluctance to contribute to the military establishments that existed only a few years ago.

The Dominion Arsenal today affords an interesting contrast between the old and the new. Many of the methods and much of the equipment antedate the World War and some of it goes back to the close of the last century; by way of contrast there are modern hydraulic presses, three up-to-date continuous annealing furnaces and the latest toolroom equipment

The products of Dominion Arsenal are small arms ammunition and cartridge cases for artillery ammunition ranging up to the 18 and 25 lb. shell sizes. During the World War the arsenal served chiefly as a pilot plant lend-

ing its experience and personnel to instruct other manufacturers in correct tooling and processing. Today the Dominion Arsenal again fills this function and in addition has gone into the mass production of ammunition. It has jumped quickly into the breach to create a source of supply of these highly important armament items while larger facilities are in the process of construction.

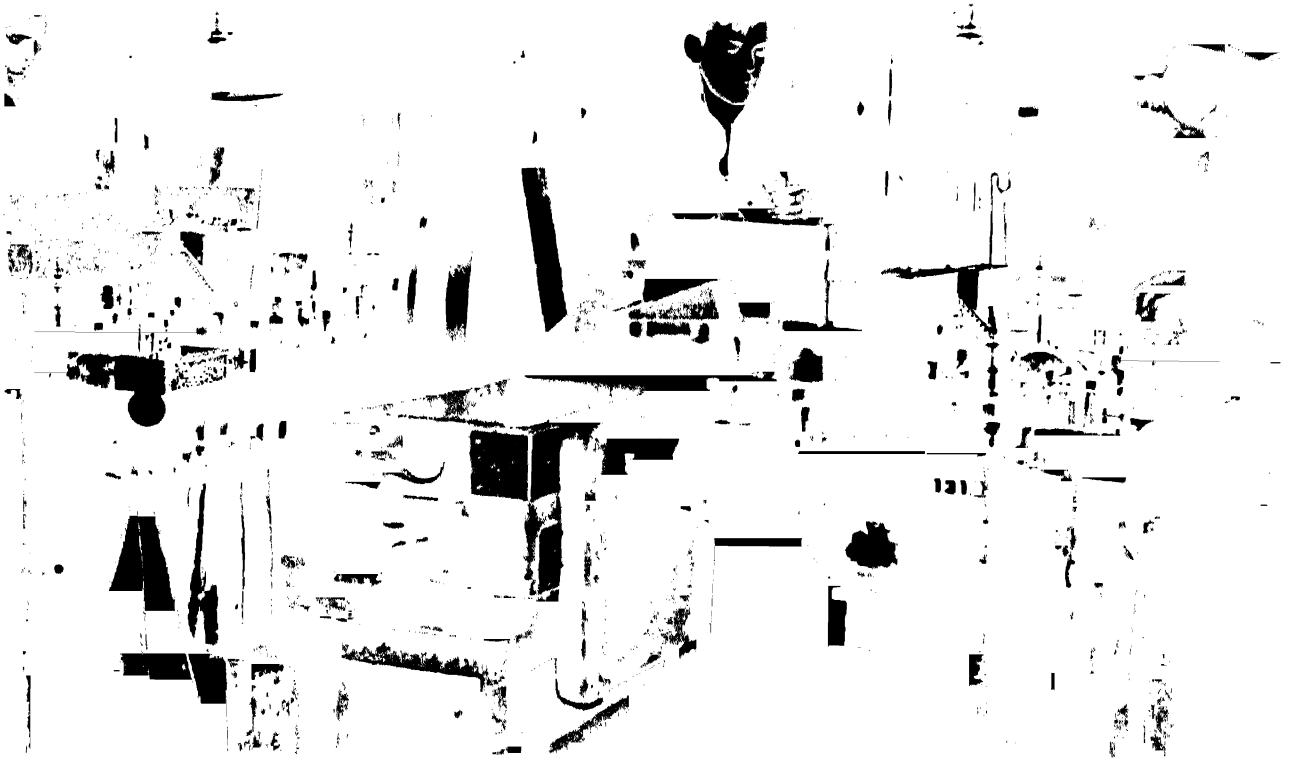
Raw materials—copper, lead, nickel and zinc—are brought into the arsenal in the form of pig metal. The arsenal does its own melting, casting, rolling, and annealing to produce the sheets and strips used to fabricate its products. Cartridge cases are made from standard cartridge brass. Bullets consist of cupro-nickel jackets filled with aluminum points and lead slugs. The aluminum is purchased as wire but the lead is melted and extruded into wire before being upset into slugs at the arsenal. Detonating caps are made of copper containing a small percentage of zinc.

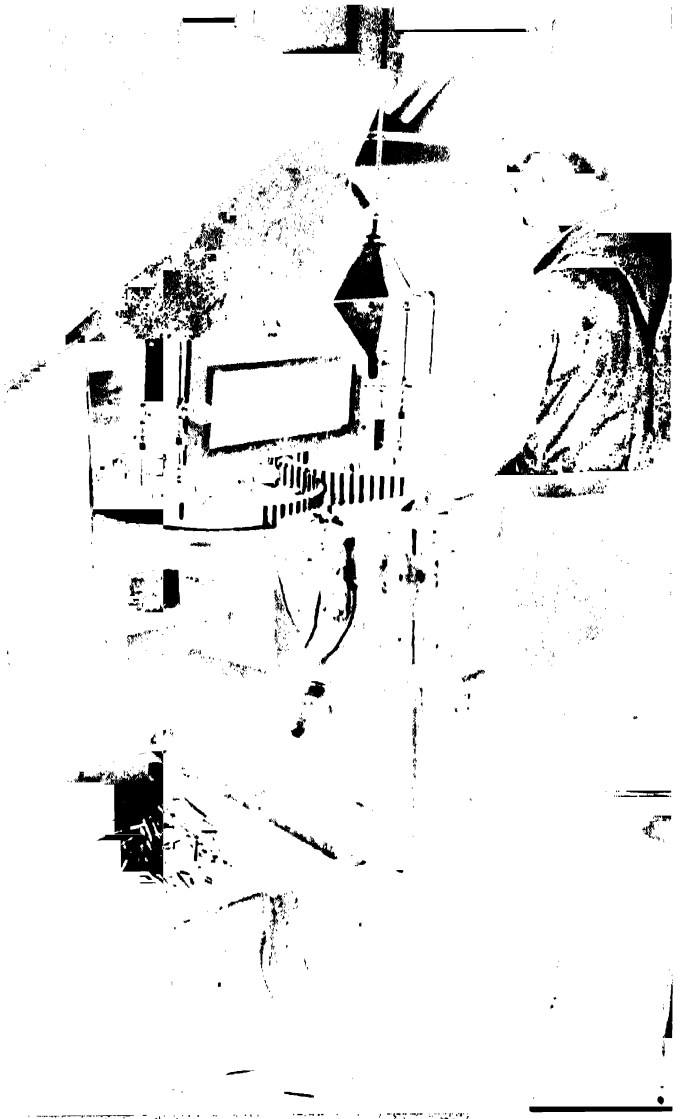
The small arms cartridge made at the Dominion Arsenal is the standard British .303 which serves for the Enfield rifle and the light Bren machine gun. Needless to say, a high degree of precision is required for machine gun cartridges. A Spitfire plane may have eight machine guns in the leading edge of the wings all inaccessible to the plane's crew. Ammunition that invites the slightest risk of a jammed gun cannot be tolerated.

Because of the need for quick expansion of output, little has been done in the way of experimentation or the adoption of radically new methods of manufacture at the Dominion Arsenal. It was felt that single operation machines of the type that had already stood the test of high production service would cause fewer delays than the more complex multiple operation designs. Where additional equipment has been added, the operating principles of the older machines are followed.

In the event of a breakdown on the single operation machine only one unit of a battery is affected causing a minimum disruption of production. The hand feeding required is done by boys below military age, most of them sixteen to eighteen years old.

Blanks for the cartridge cases are punched from the rolled brass strips. These are then cupped and given a series of four draws with an annealing and a pickling operation after each of the first three. At present this work is done in batch type furnaces and tanks but a continuous washing, annealing and pickling machine is now being installed for the .303 cartridge cases. After the third draw the





In order that they will not crack when the bullet is forced into them, the open ends of the cases are annealed. The parts are put into two rotating dials, carried through gas flames and pour out through tubes into a tote box beneath the machine

After the bullet shells have been filled with aluminum tips and lead slugs, they are closed in this crimping press. As in similar operations in the arsenal, the work feed is arranged to reduce the possibility of accident

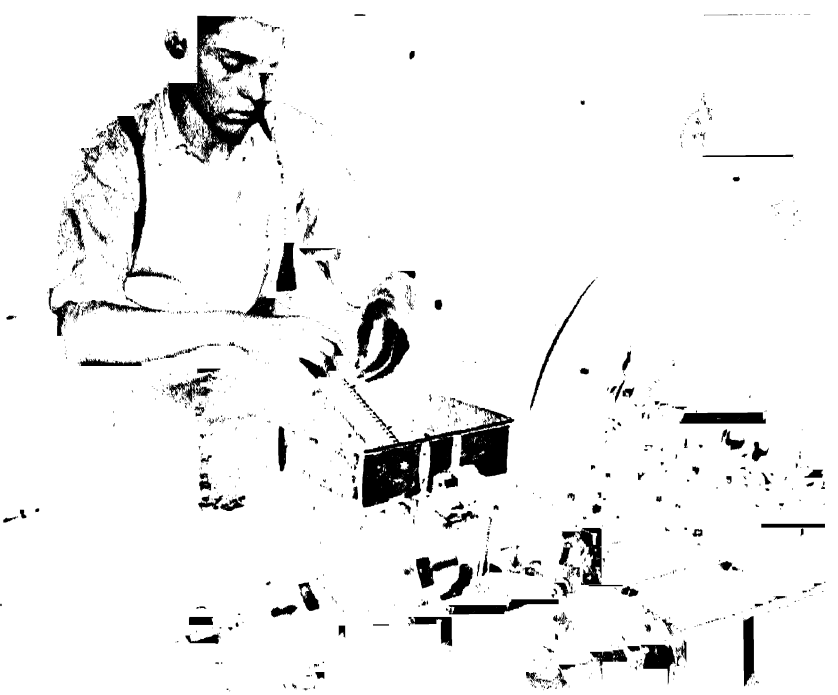
Heading the small arms cartridge cases is done in horizontal presses such as these. The parts are fed into a chute which carries them to the working position between the dies. An inspector checks work in process

cases are trimmed to length; after the fourth draw they are tapered in two steps, indented for the detonating cap, headed and pierced. The cases are then semi-annealed, that is, they are passed through a series of gas flames which heats the tapered ends leaving the lower part cool while the work is being carried by means of a continuous dial feed. A thorough washing, rinsing and drying by tumbling in sawdust makes the cases ready for filling.

Bullets are given three draws and two pointing operations. Because of their shorter length and the difference in the material, annealing is not required. The bullet shells are then filled by hand, first with the aluminum points, then with the lead slugs. The filling is driven home on a horizontal press and secured in place by means of two crimping operations on a similar kind of machine. The bullets then go through the "canneleuring" operation in which an annular groove is rolled near the blunt end. This groove is used in their assembly to the cartridge cases. The bullets are then rectified, or brought to their final size, in another horizontal press.

A new automatic machine, now in the process of installation, will complete detonating caps in one set-up.

Cases for artillery ammunition are made in a modern building next to the small arms





ammunition plant. To this building an additional story has been built for the toolroom and a new wing has been added to house two modern continuous annealing furnaces. Both these furnaces are gas-fired; one is used for the low temperature final anneal and the other for the high temperature anneals.

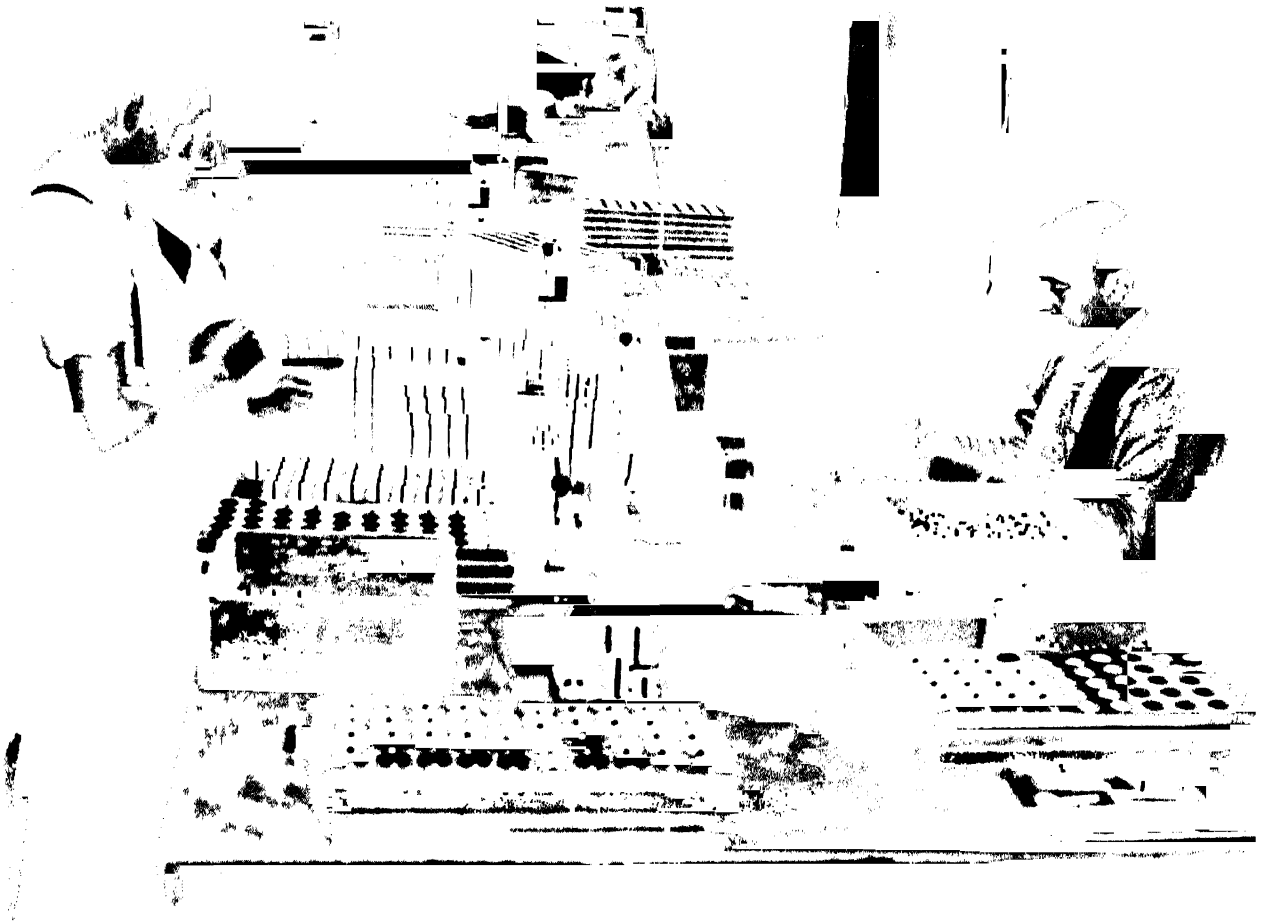
New hydraulic presses have been acquired for the production of artillery shell cases which at present consist principally of the 18 and 25 lb. sizes. The cases are given six draws with annealing and pickling operations following the first five. Pickling is now done by hand in batch-type wooden tanks. After being dipped in the acid and in a rinsing tank, the cases are dried in sawdust and blown out by hand, using an air hose. Mechanical handling methods are soon to be installed.

After drawing, the cases are indented and

The heading of artillery cartridge cases is done in this 1600-ton hydraulic press. After the head has been formed in the die, the stripper is swung into place and a second stroke releases the work

Modernization of the Dominion Arsenal is under way as exemplified by this conveyor type furnace now under construction. This unit is gas fired and will be used to anneal artillery cartridge cases between draws





ABOVE Inspection is all important where the precision of the product is a matter of life or death. This group is at work on the artillery shell primer and uses limit gages for a 100 per cent check-up of all dimensions

BELOW This turret lathe is one of the many new machines installed in Dominion Arsenal's modern toolroom. Production equipment like this is used because of the large number of punches and dies needed for shell work



headed. These steps are also performed in heavy hydraulic presses. The primer seat is machined in a standard turret lathe which cuts the thread and takes a facing cut on the base. The cases are then trimmed to length on an arbor prior to the final low temperature anneal.

Inspection of ammunition is not done at the manufacturing arsenal but at Ordnance headquarters. However, process inspection is rigid because of the close limits demanded in ammunition of this kind. The arsenal exerts close shop control including frequent preliminary inspections to insure that these standards are met.

A walk through Dominion Arsenal's modern toolroom brings to light nameplates bearing the names of most prominent manufacturers in the United States with a few British and Canadian made machines. Standard types are used throughout. In its position on the third floor of the new building the toolroom has plenty of air, light and working space. The grinding machines are segregated in a glass-inclosed space to keep the grit away from the other machines, thus protecting their precision.

The chief distinction between this and the usual toolroom is the large percentage of its work which is done on a quantity production basis. Where cartridges and cases are made in millions, punches and dies must be made in hundreds. Hence it is essential to maintain toolroom standards of accuracy on what amounts to mass production manufacture. The high quality of the equipment installed greatly facilitates this objective.

The rejuvenation of the Dominion Arsenal and its fifty-fold step-up to mass production operation is only a single instance of Canada's contribution to the current war. In a few months certain railroad shops will have been converted into a modern munitions plant. The scope of operations at Ordnance Headquarters is now being enlarged. Meanwhile the old Dominion Arsenal fills immediate needs by turning out millions of cartridges for the defense of the Empire.



For precision work on cartridge dies, this modern internal grinding machine has been installed in the Arsenal toolroom. This machine is said to be the first of its kind to be used in Canada's program for stepping up munitions output

TIME DATA SHEET NO 25

Sensitive Drill Press Operations—I

PART

Cast iron malleable iron cold rolled steel hot rolled steel cast steel brass bronze copper alloys fiber micarta asbestos slate and marble materials

OPERATION

Drill tap redrill counterbore countersink burr and ream castings and other raw material

WORK STATION

Nos 2 and 3 sensitive drill presses in the East Pittsburgh Works of the Westinghouse Electric and Manufacturing Company

CLASSIFICATION OF PARTS

Very small part	0 to 0 50 lb
Small part	0 51 to 5 00 lb
Medium part	5 01 to 20 00 lb
Large part	20 01 to 45 00 lb

ALLOWED TIME FOR SET UP

Standard Hours $= A_1 + B_1 + 0.0037C_1 + 0.0153D_1 + I_1 + 0.0173J_1 + 0.0275G_1 + 0.0093H_1 + 0.0224J_1$

Where $A_1 = 0.244$ hr for a No 2 machine
$A_1 = 0.282$ hr for a No 3 machine
$B_1 =$ 0 030 hr for each No 2 spindle drilling reaming counterboring or countersinking
$B_1 =$ 0 037 hr for each No 3 spindle drilling reaming counterboring or countersinking
C_1 = Number of coolant lines used
D_1 = Number of jigs or vises used
$I_1 =$ 0 040 hr for each No 2 spindle tapping
$I_1 =$ 0 047 hr for each No 3 spindle tapping
J_1 = Number of tapping collars put on and taken off
G_1 = Number of speed reducing pulleys put on and removed
H_1 = Number of stops set for blind holes
J_1 = Number of times steel guide blocks are put on and removed

ALLOWED TIME FOR EACH PIECE

Each piece time is found by taking the sum of the necessary operations coming under one of the headings in the following tabulations The regular formula expression has been omitted for simplicity References are made to the following tables in determining each piece allowances

Table No 1	Time to clean jig
Table No 2	Time to drill brass
Table No 3	Time to drill cast iron malleable iron copper or bronze
Table No 4	Time to drill cold rolled or hot rolled steel
Table No 5	Time to drill cast steel or axle steel
Table No 6	Time to tap brass cast iron copper or annealed steel
Table No 7	Time to tap bronze malleable iron cold rolled steel or cast steel
Table No 8	Time to drill and tap brass cast iron copper or annealed steel
Table No 9	Time to drill and tap bronze malleable iron cold rolled steel or cast steel
Table No 10	Time to ream metal
Table No 11	Miscellaneous values
Table No 12	Drill time per inch for various materials

ALLOWED TIME FOR EACH PIECE IN JIG

When a jig holding more than one piece is used allow the constant for the first piece and 0 0002 hr for each additional piece The sum of the time values for those operations which are performed only once for all the pieces must be divided by the total number of pieces in the jig

Allowance Symbol	Size of Part: Very Small	Small	Medium	Large
Constant	0 0019	0 0028	0 0051	0 0089
M_1	0 0013	0 0013	0 0018	0 0022
N_1	0 0011	0 0011	0 0014	0 0016
K	0 0003	0 0003	0 0003	0 0003
J	0 0002	0 0002	0 0002	0 0002
I_1	0 0005	0 0005	0 0011	0 0014
R_1	Table 1	Table 1	Table 1	Table 1
L_1	0 0007	0 0007	0 0016	0 0023
V_1	0 0018	0 0018	0 0018	0 0018
W_1	0 0023	0 0023	0 0023	0 0023
X_1	0 0038	0 0038	0 0038	0 0038
Y_1	0 0048	0 0048	0 0048	0 0048
Z_1	0 0054	0 0054	0 0054	0 0054
A	0 0013	0 0013	0 0013	0 0013
B	0 0019	0 0019	0 0019	0 0019
C	0 0008	0 0008	0 0008	0 0008
D	0 0030	0 0030	0 0030	0 0030
E	0 0020	0 0020	0 0020	0 0020
I	0 0010	0 0010	0 0010	0 0010
G	0 0008	0 0008	0 0008	0 0008
H	0 0047	0 0047	0 0047	0 0047

(Add machining time allowances from Tables 2 to 12 inclusive)

Where Constant = Allowance for handling time
M_1 = Number of moves to spindle or from spindle to spindle
N_1 = Number of moves from hole to hole
K = Number of holes tapped
J = Number of holes countersunk or burred
I_1 = Number of times jig is turned part way over
R_1 = Number of pieces drilled per cleaning of jig
L_1 = Number of times jig is turned over completely

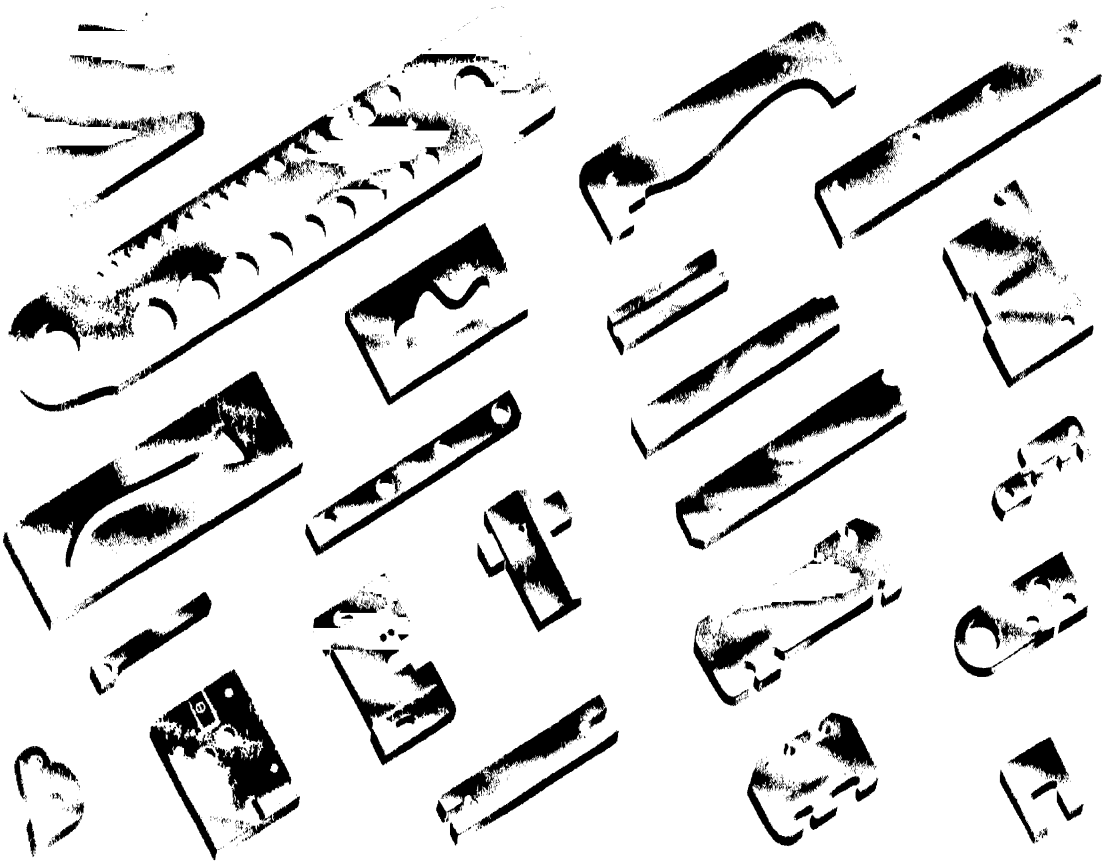
(Continued on Time Data Sheet No 26)

Note The term "allowed time" used in these and following data represents the time required by any worker to perform a given unit of work, using average skill, showing average effort, under average conditions, with average consistency, allowing for fatigue, personal needs and unavoidable delays *It is the time within which the worker is expected to perform that work* All times are given in decimal hours Accurate conversions to minutes and seconds can be made by means of the following formulas Decimal hours × 60 = decimal minutes, decimal hours × 3600 = decimal seconds The data given represents standards developed for use at East Pittsburgh Works of Westinghouse Electric & Manufacturing Company for conditions of work existing in that plant Each allowance should be checked in the light of local conditions before being applied in any other plant

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GROUND FLAT STOCK

AVAILABLE THROUGH ALL LEADING SUPPLY HOUSES

TIME DATA SHEET NO 26

Sensitive Drill Press Operations—II

(Continued from Time Data Sheet No 25)

V_1 = Number of short locating screws tightened and released
W_1 = Number of pairs of short locating screws tightened and released
X_1 = Number of long locating screws tightened and and released
Y_1 = Number of pairs of long locating screws tightened and released
Z_1 = Number of locating screws tightened and released with a wrench
A_1 = Number of thumb screws or wing nuts tightened and released
B = Number of hexagonal or square nuts tightened and released with open end wrench
C_1 = Number of times jig cover is opened and closed when hinged
D_1 = Number of times jig cover is opened and closed when not hinged
L_2 = Number of clamps put on jig
J_2 = Number of bushings used
G_2 = Number of drift pins used
H_2 = Number of locating pins used

ALLOWED TIME FOR EACH PIECE IN VISE

When more than one piece is put in a vise allow the constant for the first piece and 0 0007 hr for each additional piece The sum of the times for those operations which are performed only once for all the pieces must be divided by the total number of pieces in the vise

Allowance Symbol	Very Small	Size of Part Small	Medium	Large
Constant	0 0014	0 0019	0 0038	0 0064
M_1	0 0013	0 0013	0 0018	0 0022
N_1	0 0011	0 0011	0 0014	0 0016
K_2	0 0003	0 0003	0 0003	0 0003
J_2	0 0002	0 0002	0 0002	0 0002
L_1	0 0008	0 0008	0 0022	0 0034
$1/R_1$	0 0020	0 0020	0 0020	0 0020
P_1	0 0010	0 0010	0 0022	0 0040
Q_1	0 0044	0 0044	0 0044	0 0044
S_1	0 0040	0 0040	0 0040	0 0040

(Add machining time allowances from Tables 2 to 12 inclusive)

Where Constant = Allowance for handling time
M_1 = Number of moves to spindle or from spindle to spindle
N_1 = Number of moves from hole to hole
K_2 = Number of holes tapped
J_2 = Number of holes countersunk or burred
T_1 = Number of times part is turned over in vise
R_1 = Number of pieces drilled per cleaning of vise
P_1 = Number of times vise is tightened and released by hand
Q_1 = Number of times vise is tightened and released with rawhide mallet
S_1 = Number of times part is lined up with level or square

ALLOWED TIME FOR EACH PIECE ON TABLE

Allowance Symbol	Very Small	Size of Part Small	Medium	Large
Constant	0 0014	0 0019	0 0038	0 0064
M_1	0 0013	0 0013	0 0018	0 0022
N_1	0 0011	0 0011	0 0014	0 0016
K_2	0 0003	0 0003	0 0003	0 0003
J_2	0 0002	0 0002	0 0002	0 0002
T_1	0 0005	0 0005	0 0010	0 0020

Add machining time allowances from Tables 2 to 12 inclusive)

Where Constant = Allowance for handling time
M_1 = Number of moves to spindle or from spindle to spindle
N_1 = Number of moves from hole to hole
K_2 = Number of holes tapped
J_2 = Number of holes countersunk or burred
T_1 = Number of times part is turned over on table.

Table No 1—Clean Jig

Size of Jig	Small	Medium	Large
Clean with brush	0 0020	0 0028	0 0035
Turn jig over to clean	0 0014	0 0022	0 0029
Clean with air hose	0 0014	0 0014	0 0020

APPLICATION

This formula applies to all machining performed on Nos 2 and 3 sensitive drill presses under conditions existing on date this formula was made effective

ANALYSIS

Tools

The operator will use drills reamers taps, wrenches pliers, screw drivers and plug and thread gages All cutting tools jigs and fixtures and gages should be kept in the toolroom when not in use There they will be sharpened if cutting tools and repaired No time has been allowed the operator for sharpening his own tools

Material Handling

Material should be handled to and from the machine by a laborer It should be placed as close to the machine as possible but in such a position that it will not interfere with the movements of the operator.

Inspection

Time is allowed in the set up for taking the first piece to the inspector and for going to the inspector's bench after he has inspected the piece The operator is not supposed to wait for the inspector nor stand around while the inspection is made.

Locating Screws

A short locating screw is one which is moved $^1/_4$ in or less while a long locating screw is one that is moved more than $^1/_4$ in

Job Assignment to Machines

No definite rule can be established to determine whether a job will go on a No 2 or a No 3 drill press This depends on the size of the part the kind of material to be drilled and the size of the holes to be drilled or tapped The time study man should use his own judgment for each individual job

Power Feeds

Some No. 3 drill presses are equipped with a power feed An investigation in the shop has revealed that these machines are in the minority All data is established on the basis that hand feed will be used It is as quick as power feed

(Continued on Time Data Sheet No 27)

DEPENDABLY ACCURATE!

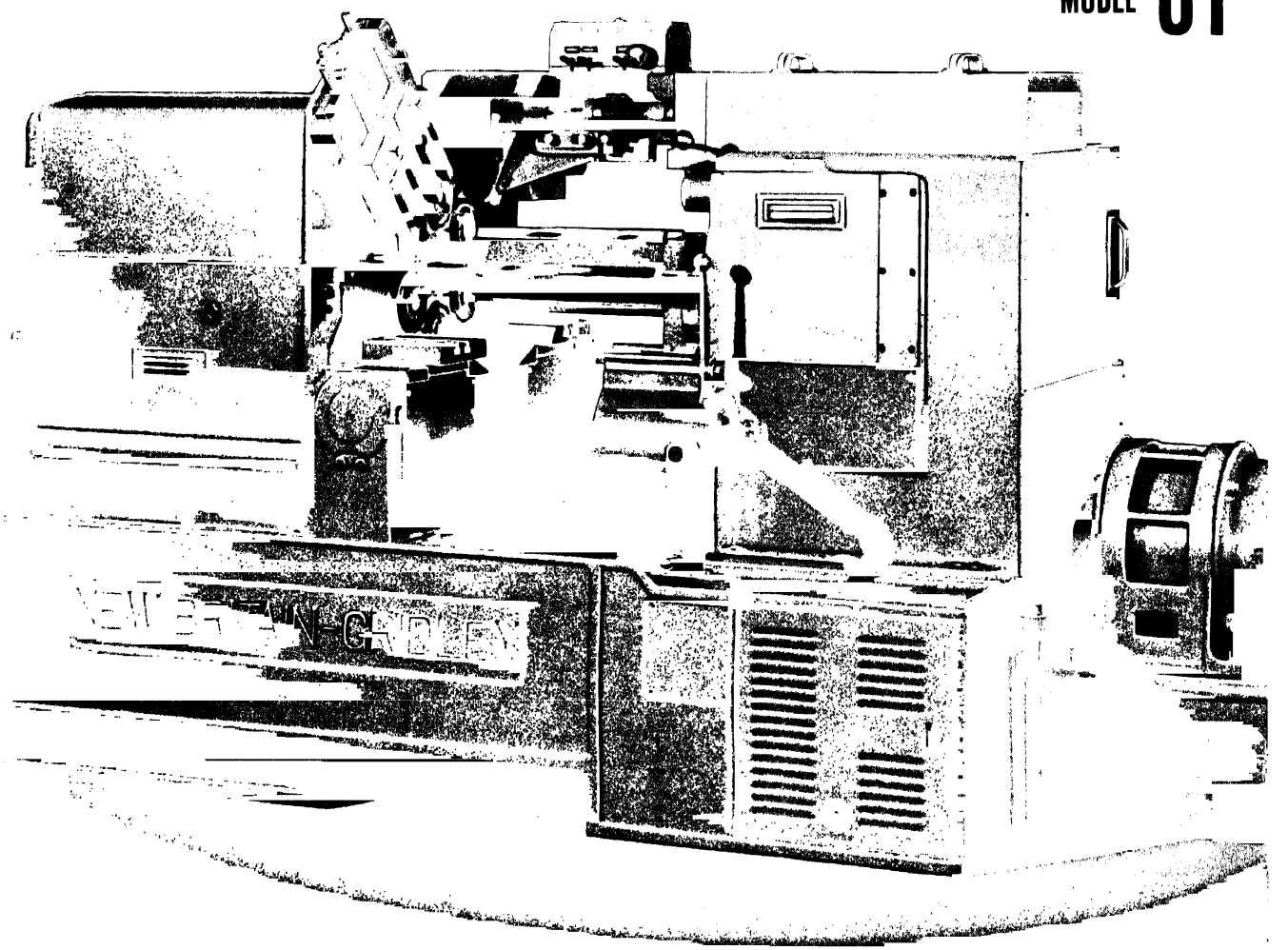
NEW BRITAIN'S complete line of 6 Spindle Automatic Screw Machines for the production of fuse bodies and components, bullet cores, small projectiles and other related parts, incorporate Exclusive Features eliminating wear at all vital points.

Automatic Spindle Carrier Lifting and Clamping Forming Slides mounted on Circular Studs with specially smooth finished bearing surfaces, and many other features are essential to maintain continuous accurate production without frequent adjustment and overhaul.

NEW BRITAIN-GRIDLEY

MACHINE DIVISION • THE NEW BRITAIN MACHINE CO.
NEW BRITAIN, CONN.

MODEL 61



A complete line of Screw Machines — Four and Six Spindles to 2¼" Capacity

How Much Sabotage?

AN EXPLOSION occurs in a powder-making plant. Without waiting for an investigation, the newspapers immediately yell "Sabotage!" A fire starts on a battleship under construction. The newspapers again present it in a sensational light and hint at dark doings. Any explosion, fire or accident of any kind in any factory with a defense contract raises the suspicion that something sinister is back of it.

We went to Washington to get the facts. They were given us by what the columnists like to call "unimpeachable authority." And they are so totally different from the general public impression that we feel it a duty to make a report on them.

Sabotage is not rampant in the United States. Known cases of it are surprisingly few. It is under better control by the proper governmental agencies than anyone thinks.

To be sure, fires and explosions are happening daily in this country, but that is to be expected when industrial activities are at an abnormally high rate. Thousands of "green" men are at work, large numbers of supervisors have just been lifted to new and responsible jobs. A considerable segment of our industrial organization hasn't yet got into the swing of doing things with the greatest efficiency.

Oh, yes, about the big Kenville, N. J., powder plant explosion. Our lips are sealed by a pledge of confidence, but we were presented with overwhelming evidence that sabotage was not involved. The "big" fire on the battleship *South Dakota* was a $50 blaze caused by a defective piece of equipment used by a workman. And so it goes.

Don't get us wrong. Everything isn't fine. Plenty of people are ready at the slightest opportunity to do mischief in connection with the defense program, particularly if it will delay help to Britain. Some obvious acts of sabotage have been turned up and will continue to be committed. Our vigilance should not be relaxed; instead it should be redoubled.

Nevertheless, an important issue is at stake. If we see hobgoblins and disguised Germans and Japanese lurking behind every fire, explosion and industrial accident in this country from now on, we will be in for a fine case of jitters. From the standpoint of our potential enemies, nothing could be sweeter. An ideal way to retard our armament program is to affect adversely the morale of industrial workers, thereby causing production to fall behind schedule.

After all, the main point is that a scare complex is not justified by the facts. Our plants are still the safest places to work in the world. It is common knowledge that more accidents happen at home than in the factory. On the basis of all available evidence, U. S. industry will continue to be the safest shelter for American workmen during their waking hours.

Whatever we do, let's not be stampeded into an unjustifiable fear of the extent of subversive activities aimed at crippling our armament production. Nothing could please Germany better than to have Americans unwittingly loose upon themselves the psychology of terror which has served German purposes so admirably in other parts of the world.

Burnham Finney

GAGING BUSINESS

Plants expand as machine tool demand grows. British order machines outside machine tool industry. Forty destroyers placed by Navy. Todd to build 60 cargo vessels for British

Machine Tools—Defense orders for machine tools are piling up and the British demand is getting hotter. If the magnitude of the defense program continues to grow, the volume of machine tool business yet to be placed is tremendous. As a result of this pressure and of Mr. Knudsen's appeal to do "the impossible," machine tool builders are surveying ways and means of stepping up operations further. Plant expansions of considerable size are getting under way. Three companies will provide new facilities, over and above those already built the past year, under terms of the so-called bankable contract with the federal government. Announcements of other factory enlargements are anticipated soon.

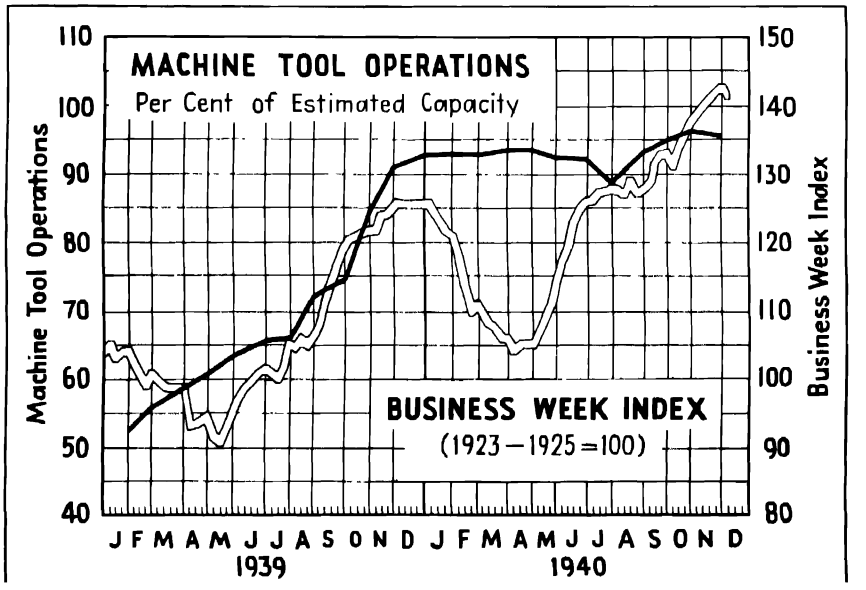
Since the war began machine tool companies are estimated to have spent over $50,000,000 for new equipment and plant additions. The industry is unanimously of the opinion that it could do a much better job of planning production ahead if Washington could provide a blueprint of exactly what the load will be. Thus far Washington has been unable to do this. Efforts are being made to locate idle machine tools in existing plants around the country and put them to work on defense sub-contracts. In Kansas City alone a survey just completed shows enough idle machine tools to equal in number the largest machine tool plant in the country. Railroad shops are said to have many machine tools which they willingly would employ on sub-contracts. British machine tool orders are not being confined to the industry itself, but are being placed with outside companies, including a can maker. The British Purchasing Commission is scouring the land to find companies with which to contract such orders. In such cases machine tools are of older design, including automatic and hand screw machines. Despite the risk of ship sinkings and of plant bombings, most of the U. S. machine tools bought by the British are still being sent to England. Good used machine tools are scarce and are bringing abnormally high prices, which in certain instances surpass the original cost of the machine.

Munitions—Designs are reported to have been frozen on most important armament items. Thus the main job now is to let contracts and push production. The munitions procurement program is believed to be proceeding at a fairly satisfactory rate, in view of the admitted time it takes to tool up plants for manufacture of unfamiliar products. In some cases companies are ahead of shedule. The Navy will erect an ordnance plant at Detroit to cost $12,000,000 to be operated on lease by a private contractor. British ordnance business to be awarded in this country totals $1,700,000,000. Final contracts will not be signed until after legislation on the President's arms lending scheme is passed.

Shipbuilding—Newest development is a surprise award of 40 more destroyers and money to expand facilities to build them at total expense of $261,684,875. Bethlehem Steel will construct four destroyers at Quincy, Mass., three at Staten Island, seven at San Francisco and six at San Pedro, Calif. Bethlehem will spend $4,250,000 for additional facilities at these yards. Bath Iron Works will build six destroyers and Federal Shipbuilding a like number. Seattle-Tacoma Shipbuilding Co., was awarded five destroyers. The Boston navy yard will build four, Philadelphia two, Norfolk two and Charleston two. The British will spend $100,000,000 for 60 cargo vessels to be constructed in the United States by the Todd Shipbuilding Corp.

Aircraft—The task of getting new fighting planes into production, of expanding plants and of training huge numbers of unskilled men has kept plane output from advancing. Shortages of certain parts also have been a troublesome factor. Assemblies, now close to 750 a month, are no better than they were a few months ago, but increased production is looked for shortly.

Allison is now turning out over 350 engines a month and soon will pass the 400 mark. Studebaker and Buick are getting nearer the time when they will formally begin preparations to build the Wright and Pratt & Whitney engines, respectively, under license agreements. Consolidated Aircraft will enlarge its plant at a cost of $14,446,929 to be financed by the Defense Plant Corp., an R.F.C. Agency. Liberty Aircraft will increase its plant for engine manufacture at Farmingdale, L. I., the government providing $1,088,000 for the project. Allison has received an order from the War Department for airplane engines totaling $69,722,625.



Capacity Increases—*The November operating activity of the machine tool industry, measured in terms of payroll hours, is 95.4 per cent. This represents an increase of 3 per cent over October, or an accumulated increase of 54.9 per cent since September, 1939*

AMORTIZATION DEADLINE

WASHINGTON — Manufacturers who have plant expansions underway and who hope to amortize it over the five year period under the new tax law must obtain "certificates of necessity" not later than February 5. It is expected that the government will be so swamped with last-minute applications Because of this, applications filed later than January 7 may not be acted upon So far, it is believed, hardly more than one-fourth of those who will want certificates have applied.

Canada's War Orders Hit Billion Mark; Make 130 Planes Monthly

MONTREAL—The total amount of war orders placed by the Canadian and British governments up to Nov 27, 1940 was $1,000,000,000, according to the chief cost accountant of the Canadian Department of Munitions and Supply Previously, the amount of war orders reported by the Department was $500,000,000, indicating that only half of the orders placed had been reported

At present Canadian plane production is about 130 machines monthly including trainers, fighters, bombers Of the output most are trainers but after the first of the year the proportion of fighters and bombers is expected to increase A new $3,000 000 plant to be built by the government in western Ontario is scheduled to be managed by Fleet Aircraft After much bickering between the government and the National Steel Car Corp, the latter's plant, which was recently expanded to the tune of $2,500,000, will be ready to swing into full production of combat planes The plant had been idle for six months during a squabble with the government

Contracts have been awarded for the construction of six additional submarine chasers Two will be built at Midland, Ont, shipyards, and four at the Pacific coast yards Canada's naval construction program has now involved an expenditure of about $70,000,000

Recent government contracts are: Aircraft, Canadian Wright, Ltd, Montreal, $15,638; Canadian Vickers, Ltd, Montreal, $59,940, National Steel Car Corp, Ltd, Malton, Ont, $422,950; and Fleet Aircraft, Ltd, Fort Erie, Ont, $18,819 Machinery, Brunner Corp, Ltd, Toronto, $37,461 Munitions, Defense Industries Ltd, Montreal, $41,300; National Steel Car Corp, Ltd, Montreal, $10,572 Ordnance, Hall Machinery, Sherbrooke, Que, $46,675

Knudsen Asks Machine Tool People "To Do the Impossible" Because of Urgency of Situation

WASHINGTON — Defense Commissioner William S Knudsen has asked machine tool builders "to do the impossible" in view of "the terrible urgency of the situation" in a letter mailed Dec 9 which said, in part:

"It is not your fault that Army and Navy requirements weren't known far enough in advance to prevent the dumping of millions of dollars worth of orders on the industry in a very short time The changes in the program week by week necessitated by changed conditions in Europe make it impossible to figure machine tool requirements very far in advance But the fact remains that practically all of you are quoting from six to twelve months delivery This delivery must be speeded up

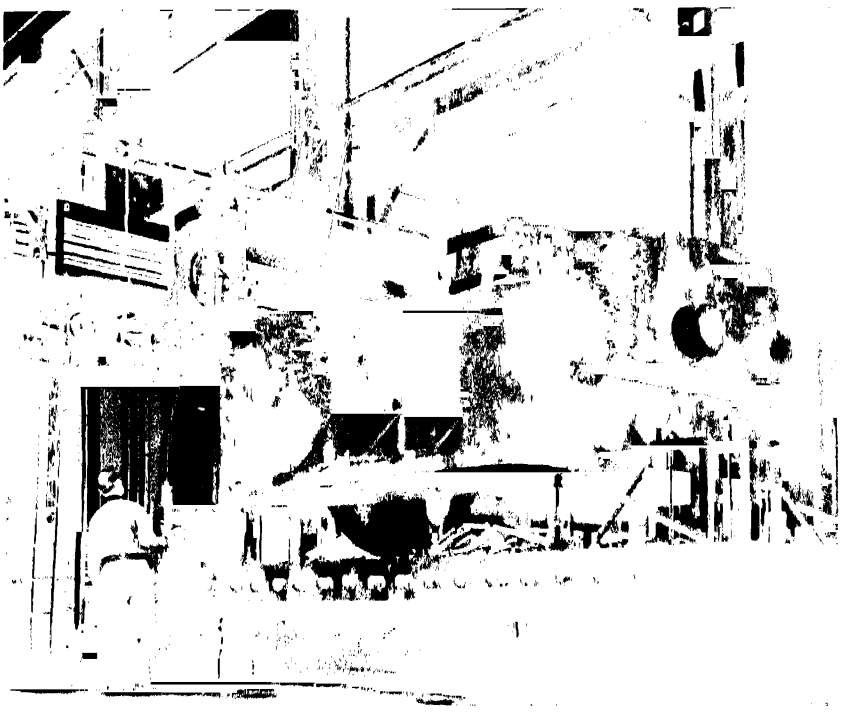
"All of you have made large plant expansions, many of you are running three and two shifts, many are subcontracting some parts, sub-assemblies and whole machines But not enough of you are doing this I realize the difficulties of sub-contracting such accurate tools as yours, but if some manufacturers can do this, more can

"If you could see as I do from the inside the terrible urgency of the situation, you would agree with me that I am not asking too much in requesting you to speed up delivery and increase the production of machine tools during 1941 Let's forget everything except the welfare of our country The industry as a whole has done practically the impossible in trebling its rate of output in the last two years I am appealing to you to do the impossible again"

In another letter to machine tool employees, to be posted in machine tool plants, Mr Knudsen said

"Do you realize that you are as important to your country today as the soldiers in the Army and the sailors in the Navy? Even more so, because they are helpless without munitions Machine tools are the most essential item in the defense program, and your job is to build them They are needed in almost unheard-of quantities for production of airplanes, anti-aircraft guns, torpedo-boat destroyers, tanks—all kinds of munitions

"Nothing is more vital to your country's welfare just now than to hasten the supplying of these desperately needed machine tools If you could see, as I do, from the inside the terrible urgency of the situation, you would understand why the Defense Commission is making this appeal to you to put everything you have, without stint into your job Only by the cooperation of everybody in this national emergency can the defense task be done in time"



Giant Planers—*At the Hydraulic Press Mfg Co, Mount Gilead, Ohio, huge castings are machined on giant double-side planers The casting on the planer (above) is the bed for an H-P-M Fastraverse press of 5000-tons pressure It weighs 142,000 lbs.*

U. S. SHIPBUILDING SOARS TO RECORD HIGH

Metal-working industry to receive over $3,080,000,000 in the next few years from U. S. shipbuilding business alone. U. S. Naval and Maritime Commission contracts are near $5,000,000,000 mark

By RICHARD K. LA BAN

WASHINGTON — Contracts awarded U. S. Naval ship construction to date total over $3,800,000,000. The remaining portion of the $7,700,000,000 naval ship construction and alteration program will be utilized for armor, armament and equipment, to be contracted for as the ships approach completion.

Meanwhile great progress has been made in expediting contracts for new ships. In addition, shipbuilding time has been materially cut. The 40-month building period for completing cruisers has been shortened as much as one-eighth, submarine construction time has been cut from 30 months to 24 months. Destroyers under construction are being launched three months ahead of schedules. At the present time, new fighting ships are going into service with the navy at the rate of one every 12 days.

Last month building in U. S. ship yards were: 16 aircraft carriers, 15 battleships, 58 cruisers, 185 destroyers, 77 submarines, and many smaller vessels. In all 392 new fighting ships, approximately 2,100,000 displacement tons, were on the way for the U. S. Navy.

New Merchant Marine

But a Navy is shorebound without a merchant marine, which brings it food, supplies, oil. In U. S. shipyards last month this lifeline, a brand new merchant marine, was also building. On the ways were 182 cargo ships with a total gross tonnage of 1,504,655.

At present every available U. S. way (approximately 100) capable of building a ship of 300 ft. or over is occupied. Private yards have experienced an approximate rise of 280 per cent in commercial tonnage, more than 600 per cent increase in Naval tonnage since Jan. 1940. As of Nov 1, the approximate value of unfinished shipbuilding business in private seaboard yards was $3,065,000,000. This represents an increase of approximately 368 per cent since Jan. 1, 1940, and an increase of 1,269 per cent since Jan. 1, 1938.

Of all American industries, shipbuilding knows the worst experience. Dependent on the Navy and (for most cargo vessels) on government subsidy, it becomes fat or lean in direct proportion to Administration policy. A dying merchant marine was revived in the World War of 1918 when the "bridge of ships" frenzy caused a three billion dollar handout to the shipbuilding industry for 2,300 vessels. Then, from 1922 to 1928, as the government slowly sold its wartime fleet, the U. S. did not build a single vessel for trans-oceanic trade.

Six years ago the U. S. recognized that prolonged inactivity of the shipbuilding industry might result in eventual disaster and decay of property. In 1935 the U. S. began to divide contracts for naval tonnage equally between government Navy yards and private builders. Another hypodermic, the U. S. Maritime Commission, was created in 1936 to guide a government subsidy of a ten year program to replace a moribund U. S. merchant fleet. In 1937 the Commission was well started on its program to provide 50 ships a year for ten years. So far (Nov. 1) construction has begun on 179 vessels of which 72 have been launched and 51 are in service. Besides the 128 now on order contracts for 321 will be let in the next five years. Program's total cost: $1,250,000,000.

Of these two building programs, the colossal Navy $7,700,000,000 upsurge and the Maritime's catalytic $1,250,000,000 the U. S. metal-working industry is scheduled to receive more than 40 per cent of the amount expended. Manufacturers of castings, forgings, lathes, drilling machines, threading machines, boring mills, shapers, grinders, pneumatic tools, electrical machinery, etc., will get $500,000,000 worth of business in the next ten years from the Maritime Commission's program alone. From the Navy's program, the metal-working industry is scheduled to receive orders in astronomical dollar values. A conservative estimate of the business which will go for all types of machinery in the next seven years: $3,080,000,000.

That shipbuilding for the U. S. Navy is not "peanuts" may be seen from the building schedule of the New York Shipbuilding Corp. In May it was building seven ships (all naval) worth $145,000,000. One of the ships, the 35,000-ton, $62,794,000 battleship "South Dakota" put the New York Shipbuilding Corp. in the odd position of a manufacturer producing a single sales unit worth more than four times as much as its total assets ($12,559,000).

With 330 major combat ships under contract, rapid expansion in the nation's shipbuilding industry has been called for to meet the new and speeded-up schedules. Present shipbuilding yards are being expanded, and new yards are being constructed on the west and gulf coasts. The enacted program for the construction of ship ways and shipyard facilities call for Navy construction totalling $150,000,000.

Under the expanded shipbuilding program, sub-contracting will be more widely spread than ever before. Such items as navigating equipment and engine assemblies will arrive in their completed form, ready for installation. Following this procedure, entire boilers will be delivered, auxiliary machinery will be completed and assembled outside the yard, thus requiring only the actual installation work to be done within the shipbuilding yards themselves. This procedure will free the larger sub-contracting facilities

Value of Shipbuilding

Unfinished Commercial and Naval Business in U. S. Private Seaboard Yards

Compiled by the National Council of American Shipbuilders

Date	Millions of Dollars Commercial Vessels	Naval Vessels	Total
Jan. 1934	$7	$140	$147
" 1935	1	118	119
" 1936	14	165	179
" 1937	50	119	169
" 1938	51	113	164
" 1939	137	255	392
" 1940	267	294	561
Nov. 1940	270	2,795	3,065

Distribution of Ways

Capable of Building Ships 300 Ft. and Over

(As of December, 1940)

	Active	Inactive but capable of repair at nominal expense
North Atlantic ...	53	16
South Atlantic ...	12	4
Gulf Coast	8	8
Pacific Coast	10	9
Great Lakes	17	3
Total	100	40

Compiled by the National Council of American Shipbuilders

DISTRIBUTION OF CONTRACTS

WASHINGTON—Under the expanded defense program, many sections of the nation will participate in the primary contracts for ship construction. A regional breakdown of the $3.800,000,000 of contracts already awarded shows that the major portion is concentrated in the northeastern section of the U. S. The geographical distribution is as follows:

New England ...	$900,000,000
Middle Atlantic.	1,000,000,000
South Atlantic..	600,000,000
Pacific Coast....	500,000,000
Great Lakes	200,000,000
Unassigned	600,000,000

for other defense projects, while the smaller machine shops throughout the nation will participate in building up materials and sub-assemblies necessary to the program.

Skilled Labor Needed

The intense activity in shipbuilding centers has resulted in a sharp rise in shipbuilding employment. The latest figures show 162,000 workers employed directly in the shipyards. As of December, 1939, employment in 33 principal private shipyards reached the 50,000 mark for the first time in two decades, while at Nov. 1, 1940, employment crossed the 70,000 mark. For every employee in the shipyards there is another employed in the plants furnishing materials for ship construction. This brings the total currently employed under the shipbuilding program to more than 300,000. By August 1941 it is estimated that 1,852,000 workers will be directly and indirectly absorbed by the entire shipbuilding industry.

However, a very real shortage of naval draftsmen, welders, riveters, machinists, is reluctantly admitted by employers who fear that workers may seize this as a basis for higher pay demands. Shipbuilders are now luring students from the marine architectural courses before graduation, for instance, with a salary triple that which degree-holders from the same courses were able to grab a year ago.

Almost all private shipyards have increased the number of apprentices and have established training schools in the yards to increase the supply of available labor. President Roosevelt, who did not agree that a labor shortage existed, barred any increase in the working hours on July 2 until about 2,000,000 unemployed has been absorbed by industry.

The average annual earnings in Navy yards of all employees working 12 months in 1935 were $1,909, in private yards on the Atlantic Coast average annual earnings were $1,500. Similar figures were recorded for 1938. The higher averages in the Navy yards was due to considerably higher hourly earnings and longer weekly hours. Since 1935, however, private shipyards have increased the hourly earnings and weekly hours, granting vacations with pay to some employees, and provided stable employment.

For 1940 a slight rise in annual earnings was recorded for workers in both Navy and private yards. The present demand for labor far exceeds the supply. Wages, hours, and annual earnings soon will experience an abnormal rise. However, the rise will be slow as shipbuilders have labor union contracts calling for present wage rates to be paid for some time. As these contracts expire, higher rates will undoubtedly be paid all over the U S.

In order to explore ways and means of stabilizing employment in the nation's shipyards, the Labor Division of the National Defense Commission has appointed a Shipbuilding Stabilization Committee, headed by Sidney Hillman, to undertake a detailed investigation of wage rates, working conditions, migration of workers and its effect on production.

U. S. Private Yard Construction

Self-propelled Seagoing Commercial and Naval Tonnage Under Contract 1935-1940

Compiled by the National Council of American Shipbuilders

	No. of vessels	Tons
	1935	
Commercial ...	2	19,022
Naval	33	140,000
Total ...	35	159,022
	1936	
Commercial ...	16	92,074
Naval	46	182,024
Total ...	62	274,098
	1937	
Commercial ...	30	189,090
Naval	39	160,930
Total ...	69	350,020
	1938	
Commercial ...	32	235,250
Naval	36	144,650
Total ...	68	379,900
	1939	
Commercial ...	59	538,100
Naval	38	209,620
Total ...	97	747,720
	1940 (Estimate)	
Commercial ...	182	1,504,655
Naval	392	1,300,000
Total	574	2,804,655



Down The Ways—*Goes the 395 ft. C-1 type cargo vessel, the Joseph Lykes. Built by the Federal Shipbuilding and Drydock Co., the ship weighs 6,829 gross tons, was launched Aug. 1940. The ship was built as a part of the U. S. Maritime Commission's program to build 500 ships in ten years at a cost of $1,250,000,000*

Last Year's Machine Tool Products Were Worth Over $300,000,000

WASHINGTON—The value of products for the machine tool industry last year was $218,044,728, plus $125,630,124 for accessories. Metal-working machinery not elsewhere classified amounted to $98,975,454. The total of all types of machinery was over $580,000,000, as indicated by a preliminary report from Department of Commerce, Bureau of Census.

A total of $49,956,214 of new machinery of specialized types was manufactured last year for selected industries which included machinery used in cotton-ginning, in the working of glass, cement, incandescent lamps, clay, rubber, stone and leather, in hat and shoe-making. In 1937 these items amounted to $55,706,659, or a decline of about 10 per cent in the two-year period.

MORE ELECTRIC TRUCK SALES

CHICAGO—A total of 249 units of electric trucks and tractors were booked in November, 1940, as compared with the previous high of 193 units recorded in October of this year. Total net value of the chassis only was $827,003 as against the October figure of $653,682.

KNUDSEN ASKS DEFENSE EFFORT ON WAR BASIS

"Total Preparedness for America's Future" stressed by speakers at meeting of National Association of Manufacturers. Industry pledges full support to co-operate in national defense program

NEW YORK—"Total Preparedness for America's Future" was the theme of the Congress of American Industry held under the auspices of the National Association of Manufacturers Dec. 11-13. The defense program and the part which industry will play in it was foremost in the minds of most speakers. The meeting reached a climax at the annual dinner when Defense Commissioner William S. Knudsen pleaded for the national defense effort to be put on a war basis and for industry to end the Friday to Monday "black-out of factory" by operating on Saturdays. He expressed doubt whether the defense job has been adequately sold to the two most important elements, industry and labor, though the public generally is sold.

Plane Production Scaled Down

Mr. Knudsen said that the airplane production schedule, which called for 1,000 units a month by Jan. 1, has had to be scaled down 30 per cent. Most of the heavy combat planes are new models not heretofore in production, and that has slowed down output. Engine companies are behind schedule and need equipment. Guns and machine guns are still in the tooling stage. However, jobs that are wholly on machines will pick up fast when the tools are ready because assembling is the smaller part of the hours per job. The same reasoning applies to powder and its ingredients. Light tanks are being produced at a rate of four a day and medium tanks will be available from six plants by mid-summer.

In round figures, the defense program means: 50,000 airplanes; 130,000 engines; 17,000 heavy guns; 25,000 light guns; 13,000 trench mortars; 33,000,000 shells loaded; 9,200 tanks; 300,000 machine guns and ammunition; 400,000 automatic rifles and ammunition; 1,300,000 regular rifles and ammunition; 380 Navy ships; 200 mercantile ships; 210 camps and cantonments; 40 government factories; and clothing and other equipment for 1,200,000 men. British material placed in the United States at present is included in these totals. Altogether the program will require 18,000,000,000 man-hours.

"Have we done everything we can to utilize existing facilities and offer them to companies having defense contracts?" asked Mr. Knudsen. "Can we subcontract more of our work and spread it so as to make speed and more speed that way? Every manufacturing concern which has a defense contract should be informed of idle facilities in the locality so as to confine the new equipment as far as possible to special machinery. Our machine tool industry is working hard and well on its job. It has set a very good example of speeding up before us and it is about the way other items of defense will have to proceed if we are going to make time."

Speaking on "The Problem of the Supply of Labor," Clifford S. Stilwell, executive vice-president Warner & Swasey Co., pointed out that 18 productive civilians now are needed in support of each man in active military duty, as against two in the first World War. Should the U. S. be called upon to match the productivity of the German war program, the load to be carried by industry in contrast with 1917 is tremendous. Thus modern war is primarily a war of supporting industry.

Mr. Stilwell illustrated the problem of labor by reference to the machine tool industry. From a normal demand of $100,000,000 a year machine tool builders have been confronted with orders of $500,000,000 and with specifications which call for immediate delivery.

The expansion problem has been difficult because no one so far has been able to tell just what types of machines must be produced or in what quantities. If and when the defense program will produce a schedule of its needs in machine tools, that schedule will be accomplished.

The industry in the last twelve months has recruited 40,000 men, thus doubling its personnel. "We were not far advanced in this somewhat explosive transition," said Mr. Stilwell, "before the supply of available skilled mechanics in most industrial communities was well nigh exhausted, and now no longer exists. Despite continued claims of a substantial available supply of such men, these sources are being constantly explored with disappointing success. The problem is one of training either men of no experience or of retraining older men without experience and background in tool building. It is being accomplished."

Short Term Program

Amazing results have been secured from short-term or learner programs of training, asserted Mr. Stilwell. The sources of material for such training are necessarily random Technical high schools, colleges and engineering schools have been fruitful sources. The procedure in training these people depended first upon the cooperation of older employees in personally sponsoring the individual candidates The natural aversion of organized labor to this somewhat unlimited introduction of men in a given trade was overcome by having the older employee understand the critical nature of the circumstances. The turnover has been remarkably low.

After two to three months, virtually all of the "learners" at Warner & Swasey have proved satisfactory as machine operators and for bench and assembly operations. A large number have become skilled workers within a



Charles Kettering, vice president, General Motors Corp.; William Knudsen, National Defense Commission; Clifford Stilwell, executive vice president, Warner & Swasey Co.; and Philip D. Reed, chairman of the board, General Electric Co., all spoke at the National Association of Manufacturers' meeting

Export of Machinery During October, 1940

	October 1940	September 1940	October 1939
Electrical Machinery and Apparatus	$10,494,951	$9,688,513	$9,555,739
Power-generating machinery, except automotive and electric	1,895,021	1,588,044	1,125,961
Construction and conveying machinery	2,750,359	2,075,348	1,905,494
Mining, well and pumping machinery	3,491,008	3,220,322	4,448,900
Power-driven metal-working machinery	26,798,995	22,452,289	9,121,340
Other metal-working machinery	811,255	750,880	464,060
Textile machinery	1,219,550	1,024,113	753,809

Metal-Working Machinery

Engine lathes	$1,755,049	$850,509	$546,071
Turret lathes	2,161,490	1,826,706	764,549
Other lathes	3,027,585	1,204,697	335,440
Vertical boring mills and chucking machines	810,941	845,087	315,315
Thread cutting and automatic screw machines	2,976,694	2,450,812	523,542
Knee and column type milling machines	1,509,884	2,080,354	649,627
Other milling machines	3,407,275	2,601,123	507,721
Gear cutting machines	640,646	629,083	305,383
Vertical drilling machines	312,373	408,458	90,616
Radial drilling machines	460,875	246,406	87,080
Other drilling machines	550,548	739,130	145,239
Planers and shapers	580,046	666,875	192,415
Surface grinding machines	882,574	553,676	279,525
External cylindrical grinding machines	659,388	348,385	430,569
Internal grinding machines	603,766	380,363	458,923
Tool grinding, cutter grinding and universal grinding machines	886,130	617,770	325,388
Other metal-grinding machines and parts	1,607,447	1,217,316	625,358
Sheet and plate metal-working machines and parts	652,371	828,297	487,938
Forging machinery and parts	422,102	948,975	301,243
Rolling mill machinery and parts	368,777	1,100,016	381,931
Molding machines	23,764	32,818	9,833
Other foundry equipment and parts	201,671	126,083	125,484
Other power-driven metal-working machinery and parts	2,263,128	1,731,624	1,025,858
Pneumatic portable tools	110,875	110,244	120,293
Other portable and hand or foot-operated metal-working machines and parts	208,359	191,805	112,208
Chucks for machine tools	73,852	62,345	50,454
Milling cutters, machine-operated threading dies and taps, and similar machine-operated metal cutting tools	136,819	116,555	55,464
Other metal-working machine tools and parts	281,320	269,931	125,641

second period of two to four months. Three such young men now operate a plane on the base of turret lathes. A considerable group of men ranging in age up to 45 and 50 years have shown remarkable ability for certain jobs.

Mr. Stilwell emphasized the difficulty of securing quickly the type of foremen who can deal as successfully with the human problem as with the other factors of production. He said, "A great deal of the trouble of employer and employee relations arises not so much from antagonism to management policy as from failure on the part of the foreman clearly to interpret these policies to the men in line."

If there is any single element of the present German philosophy which might be acceptable in our own scheme of American freedom, remarked Mr. Stilwell, it is that no measure of value can be substituted for work.

Philip D. Reed, chairman of the board General Electric Co., analyzed the economic problems resulting from the war in Europe and the possible means of their solution. He believes that a condition of internal economic health in the post-war future can only result from a carefully planned and projected program participated in by organized labor, by trade and civic organizations throughout the country, and by the government. This program calls for rigid reduction of government expenditures for non-defense purposes.

The Congress of American Industry pledged itself (1) to continue to defend against attack from any source the American concept of freedom, (2) to exert its utmost effort in cooperation with the government to carry out the program of national defense with all possible speed and efficiency, (3) to maintain at the same time, as far as possible, production of goods and services to meet normal needs, (4) to do its full part to prevent or cushion a threatened post-war economic depression by supporting and following practices which will contribute to maintenance of a healthy economic life; and (5) to continue to promote within industry recognition and fulfillment of the economic and social responsibilities which industrial management shares with other groups for the improvement and advancement of the general welfare.

WILL LEASE MACHINE TOOLS

WASHINGTON — Army arsenals want to lease 2,100 machine tools to people who need them for defense work. Lease fee is 12½ per cent of today's estimated value based on 50 per cent of roginal cost if machine is 5–10 years old, 40 per cent if machine is 11–15 years old, and 25 per cent if machine is over 15 years old. Boring mills, large lathes, millers, profilers and planers are included in the list. Anyone interested should get in touch with his district ordnance office.

U.S. Machinery Exports Hit New Record, Metal-Working Increases

WASHINGTON—Exports of machinery from the U. S. during October reached the record value of $43,567,434, surpassing by nearly $2,000,000 the previous high established in December, 1920. All the major machinery classes shared in the gains, but shipments of power-driven metal-working machinery showed the largest increase, rising to the record value of $26,798,995, a 20 per cent increase over September.

October exports of mining, well, and pumping equipment totaled $3,491,008, a gain of 8 per cent over September shipments valued at $3,220,322. A 33 per cent gain was recorded for shipments of construction and conveying equipment, which reached $2,750,359 in October as against $2,075,348 in the preceding month. Power-generating machinery valued at $1,895,921 was shipped from the U. S. in October, an increase of nearly 20 per cent over September exports amounting to $1,588,044.

Willys-Overland Leases Machinery Equipment to Fill Shell Order

TOLEDO — Willys-Overland Motors, Inc., expects to get going on its big shell parts and munitions contract early in April. To fill its order for $8,750,000 of ammunition components the company is now negotiating on a lease of $1,600,000 of machinery to equip its plants for the task. It will get the machine tools from the government under the plan whereby the Defense Plant Corp., a subsidiary of RFC, furnishes equipment for manufacturers. The leasing device merely eliminates the necessity of the company borrowing money for equipment.

PRIORITIES FOR SUB-CONTRACTORS

WASHINGTON — Small manufacturers working on sub-contracts involved in the national defense program are now subject to potential federal priority regulation as a result of an executive order by the president. This action enables the Government at any time to force subcontractors to put aside any private orders or contracts and devote their time to filling orders placed by the Army or the Navy. On Oct. 22 the President had issued an order giving the Priorities Board authority to recommend priorities where necessary among primary contractors. So far the Priorities Board has not invoked priority in any industry. Instead the Board, backed by the reserve authority of the President's first order, has cooperated with trade associations.

INSIDE DETROIT

Auto production likely to be 4,685,000 units during the 1940 calendar year. Relations between auto companies and labor are more amicable; G-M and Chrysler finish negotiations quickly

BY RUPERT LE GRAND, DETROIT EDITOR

DETROIT—Automotive circles anticipate that December output of cars and trucks will be close to the 500,000 mark. While this figure is down slightly from the October and November figures (514,374 and 514,500 respectively), it is sufficient to push the fourth quarter into new high ground for the industry. Auguries for the first quarter of 1941 point to operations stabilized near the present production rate, and the possibility that the new record set in the first 90 days of this year will be surpassed.

Production for the calender year 1940 is thus likely to be 4,685,000 units in round numbers, or 25.5 per cent ahead of 1939. The first eleven months of the year accounted for 4,188,934 cars and trucks, or 28 per cent ahead of the comparable period a year earlier.

Auto-Plane Program

The Automotive Committee for Air Defense has had to mark time somewhat in completing the bomber-parts display at its headquarters in the Graham-Paige plant, Detroit. Most of the delay is attributable to the fact that the bombers selected for the mass-production program are new types, and it is difficult to assemble sample parts and blueprints thereof for shipment to Detroit. Nevertheless, the 40,000 sq.ft. exhibition space is being gradually filled up. Most recent additions have been a stabilizer and part of a fuselage. Local automotive concerns possessing sub-contracts with the aviation industry are cooperating in the educational work.

The Auto Committee has made it clear that its function is comparable to that of the National Defense Commission, namely, make sure that capacity to perform the assigned jobs is available, and that efficient utilization of manufacturing facilities is attained. It will not have the power or responsibility for placing contracts. Contracts for production of parts and sub-assemblies will be placed with automotive companies by the plane makers holding contracts with the government to deliver finished planes.

Companies wishing to figure on aircraft parts are invited to visit the exhibit (a special pass must be obtained) or write the committee describing the type of work and volume of the establishment, the character of equipment installed and the personnel. Next the potential supplier may embark upon experimental studies of the parts he would like to manufacture, and await call from the committee for a more complete appraisal of his plant facilities, or he may immediately seek orders from aircraft manufacturers who may need assistance to expedite contracts now underway.

Three Point Attack

The time schedule for the bomber-procurement program has not been set by the government, but meanwhile the Committee is undertaking a three-point attack on the project:

1. To acquaint as many prospective suppliers as possible with the type of work to be done, so that they can start figuring ways and means. Several hundred companies have already sent representatives to the exhibit, and are now figuring production methods. High officials of Ford and Chrysler have been there several times. A valuable by-product of the exhibition is bringing parts suppliers together with aircraft companies now needing assistance with present contracts. For example, Eureka Vacuum Cleaner, Detroit, obtained a $250,000 contract from Martin for aluminum parts. Neither company had previously suspected that the other needed or wanted its services.

2. To obtain for automotive production men some knowledge of aircraft production problems, and the methods of manufacture worked out in aircraft plants. The committee now has a technical staff consisting of W. F. DeGroat, formerly chief engineer of Barkley-Grow; Charles D. Koch, formerly project engineer of the same company; and W. F. Johnston, for ten years in various capacities with Boeing, including production. The Army Air Corps is also keeping men on hand at the exhibit to explain parts and methods.

3. To survey and list facilities in the automotive field and related industries, so that once the assemblers are ready to go, they will have before them a thorough "blueprint" of the sources of supply at their disposal. It appears that this stage will not be reached until some time in the spring.

PLANE PARTS DELAYED

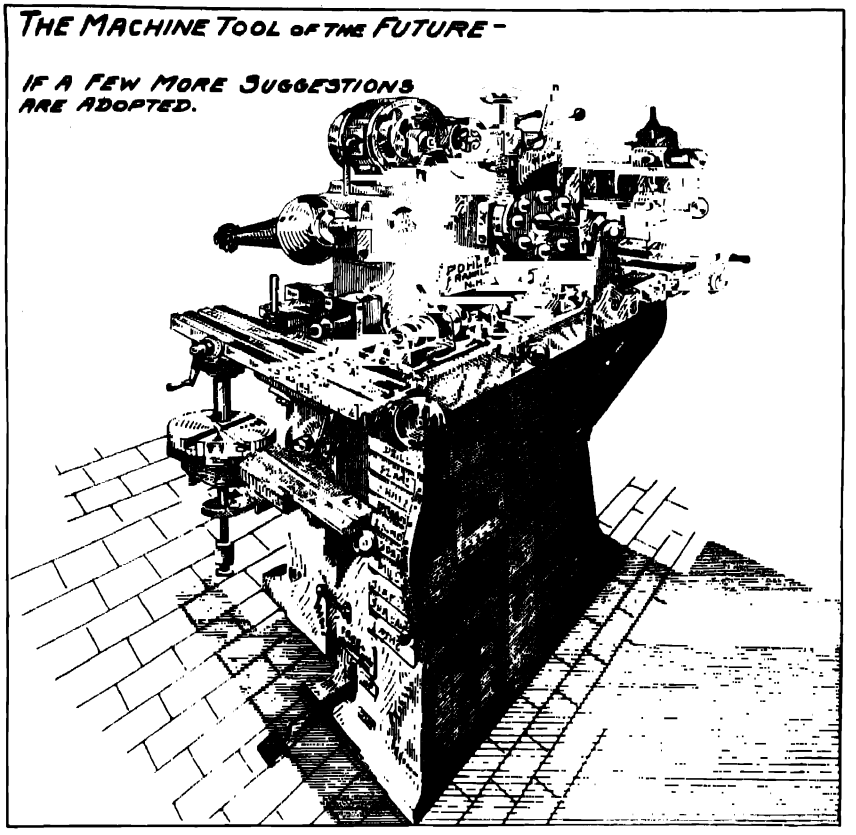
DETROIT—Airplane parts manufacture by automobile companies is a long way off. The letting of contracts alone will likely take four or five months. Many factors have slowed the program. Most automotive parts equipment is not suitable for the new job, and tooling will have to be "from the ground up". Automobile makers will not tackle production of aluminum forged aircraft parts which are regarded as a bottleneck. The job is tricky and they have had no experience at it. Forgings will continue to be furnished by a few companies with the "know-how". Two more big airplane assembly plants will be built, in addition to the two already announced. One may be in Indiana. Army objects to any more munitions factories being put at Detroit.

In sharp contrast to a year ago, auto companies and labor seem able to sit down amiably and reach a quick decision upon revisions of contracts. The General Motors negotiations this spring were settled without violence as contrasted to the bitter tool and die strike the previous summer. Chrysler wound up its negotiations in two weeks, compared to experiencing a slowdown and an eleven weeks shutdown last year. Briggs and Hudson concluded new agreements practically without public notice until they were signed.

Both sides in these negotiations had had previous experience in measuring the motives and fighting powers of the other. For public consumption, and that of the union rank and file, the union demands were skyhigh. Actually, both sides knew just about how far the other would go, also how much face had to be saved on either side.

The Chrysler settlement is noteworthy for three things: (1) the 1939 contract was renewed in full, (2) wage rates were frozen for one year in return for two cents an hour and a $40 Christmas bonus to persons with at least one year's seniority and (3) the company went half way on a union demand that multiple-shift operators be paid for eight hours, and get time off for lunch. Actually the men will now work 7¾ hr. instead of 7½ hr., with one quarter hour for lunch and get eight hours pay.

Union sources claim that the bonus and wage increase will net its members in eleven plants $6,744,000 per year. Other sources figure that the corporation will disburse about $4,500,000 extra. The company pays a Christmas bonus but does not accede to the principle of vacations with



Card—*R. F. Pohle, catalog illustrator, sends this greeting which takes a friendly poke at machine builders who sit up nights thinking of new gadgets to hang on their products*

Japan's Imports Troubled Little By U. S. Export Restrictions

TOKYO—Although Japanese import statistics are no longer released for publication, private records at the principal import organizations indicate that the month-to-month trend of Japanese imports has set new spectacular records during October and November. Little difficulty is apparently experienced in obtaining clearance papers as required under U. S. Export Licensing regulations.

During the past year investments in the machinery and tool industry have reached approximately $120,085,000. Investments in bonds and shares of machinery and machine tool concerns have now reached a total of $714,-987,500, making it the largest single manufacturing industry in point of capitalization. This figure accounts for 8 per cent of all registered corporate capital in Japan.

If and when the U. S. and Japan go to war, many American concerns will have to "write-off" large investments. Americans hold investments in the Japanese government, power plants and in American manufacturing industries in Japan. In the last group alone, which is the smallest of all, total investments amount to some $60,000,000, most of which comes under the heading of machinery and machine tools.

pay, or vacation allowance, as in the General Motors contract. Furthermore, it is understood that the total increase granted the union does not exceed one-half the amount distributed as bonus to employees in good years prior to the union. On the other hand, the union can say that its members are now receiving perhaps the top scale in the industry. And many of the older workers will tell you that their annual incomes used to be higher.

The Briggs contract provides a $40 Christmas bonus to 17,000-18,000 workers and a two-cent-an-hour raise.

These settlements leave the way clear for the UAW-CIO to attempt to organize fully the parts industry, the aircraft-parts plants in the Middle West and on the Pacific Coast and the drive on Ford. The union is silent on its strategy after petitioning Ford for an election and having it refused. Recently the Dearborn handbill ordnance designed to prohibit distribution of union literature at Ford gates was thrown out by the courts. Some time ago Ford issued a statement to show that its workers enjoyed stabilized employment and high annual incomes. The union asserts that rates are well below those of G.M. and Chrysler. With the lid partially off so far as reaching Ford workers is concerned, the battle of the century is in the making.

Discuss Speed-up of Standards for Defense At American Standards Association Meeting

NEW YORK—The annual meeting of the American Standards Association held recently was devoted to speeding-up the framing of standards for items used in the national defense program. Already this year the Association has adopted 73 new industrial standards. During the sessions R. E. Zimmerman, vice-president of U. S. Steel Corp., was elected president of the Association, succeeding Edmund A. Prentis who headed the organization for the past two years, and R. P. Anderson of the American Petroleum Institute was re-elected chairman of the Standards Council which is in charge of all A.S.A. technical work.

Probably the most important standard in the mechanical field to be approved by the A.S.A. in the past year is one on twist drills. Also approved during the year were standards on cast-iron pipes, steel pipe flanges and fittings, and spur gearing.

Retiring president E. A. Prentis, called attention to the fact that the defense program had highlighted almost all standardization work in the mechanical field in the past year. One of the problems of the coming year, he said, would be to speed up procedure on undertakings most urgently needed for defense, including work on screw threads, bolts, nuts and wrench openings, on machine pins, on wire and sheet metal gauges, and on the fit of machine parts.

Representative Hattan W. Sumers, vice-chairman of the Temporary National Economic Committee, asserted at the meeting that a great need exists in preserving a democracy of opportunity for large, medium and small business.

EXTEND EXPORT LICENSES

WASHINGTON — President Roosevelt has applied increased economic pressure against Japan through a proclamation placing iron ore, pig iron, ferro alloys and certain iron and steel manufactures under export license requirements, effective December 30. Although licenses are required to export these articles to most other countries, Japan has been buying increased quantities of these materials from the U. S. since the export ban was put on iron and steel scrap in October and will be hard hit.

WATCHING WASHINGTON

U. S. aid to Britain will be greatly increased. Arms production here seen as undergoing a change of tempo as it is geared for optimum output a year from now. Social legislation interferes

By BLAINE STUBBLEFIELD

WASHINGTON—It is easy to overestimate the immediate effects upon industry of the President's policy of loaning armament to Britain. It is primarily a financial and political rather than a production matter. However, the new policy does not affect the volume of arms produced in this country, but grants credits to Britain, specifies payments in goods rather than in cash. Obvious intent is to erect a guarantee against such a situation as existed after the last war when high tariffs impeded payment of war debts.

The plan will however have a host of incidental effects arising from the fact that the producers of arms for the British will be dealing with the U. S. Government rather than a British purchasing commission. Plenty of manufacturers have felt that however many restrictions are placed around U. S. arms production, there would always be a little profit in the British orders. In the future it will be just as unpatriotic to haggle over a British as an American gun.

Meanwhile the arms production seems to be undergoing a change of tempo. It is tied to the increasing belief in the administration that this coming Spring will decide whether Britain wins or loses the war, while U. S. arms production, more or less inevitably, is geared for maximum output a year from now. And it bears deeply upon the fundamental controversy which has developed within the administration in recent months as to the extent to which a military economy shall be allowed to supersede a civil economy.

Two speeches, by Defense Commissioner Knudsen and Priority Administrator Nelson, delivered the same night and obviously intended to be read together, opened up the question. What made the headlines was Knudsen's admission that arms production, particularly aircraft, is lagging behind the schedules set up last June. Readers of AMERICAN MACHINIST have known of this situation for some time. But this does not necessarily mean that arms production is bogging down. An output of 700-800 planes a month and of four tanks a day, for instance, is nothing to sneeze at. The schedules were drawn on the hope of miracles—and no miracles occurred.

More important in the long run is the new temper revealed. Position of the President so far and of administration economists still is that the defense program can be carried out without restricting the supply of civil commodities and without relaxing any of the New Deal's labor laws. Crucial to this program of course is maximum expansion in those industries which serve both civil and military needs.

Great Expansion Held Unwise

This whole approach has been resented in some sectors of industry. It was felt unwise greatly to expand plant not immediately needed for arms. Even though the government took the capital loss of excess plant after the war, they foresaw that the very existence of such plant would create an extreme buyers' market making difficult the profitable operation of any plant.

This attack upon maintenance of a peacetime economy has now been reinforced from a new direction. The business wing of the defense commission insists that quick arms production—quick enough to do Britain any good—cannot be attained without interference with normal life "If this program could have been taken in one stride," said Nelson, "with no disturbance to normalcy, then it was too small." To maintain that we can do the arms job and still continue business as usual, he says, is practically "fifth columny."

It is significant that, in urging greater production, Knudsen stressed three-shift, seven-day operation, rather than expansion. Expansion is slow, though it may lead to a greater eventual output. And to expand merely to avoid rationing butter may mean the diversion of attention and resources which could otherwise be devoted to guns.

Clearly evident in the new line is the implication that New Deal labor standards cannot be maintained. That "we can do more work in fewer hours" is a paraphrase, or at least parody, of the President's statement of a few months ago, and it was listed by Nelson among the slogans of the fifth column. Knudsen lined himself up against boycotting Wagner Act violators. Labor must voluntarily work harder and longer, said Nelson. Knudsen is troubled by the same question that arose in the Vultee strike—that labor is not sold on the urgency of the arms program.

Social Legislation Interferes

First official assertion that social legislation has interferred with armament production came with a release this month of the annual report of the Navy's Bureau of Supplies and Accounts. The Walsh-Healey law requiring government contractors to pay time and a half after forty hours and to pay prevailing wages has made it very difficult to obtain bids for Navy supplies, according to Rear Admiral Ray Spears. In particular promulgation of minimum wage determinations for the iron and steel industry has "practically eliminated competition in this industry." Only one steel producer willing to accept Walsh-Healey stipulations produces a complete range of supplies, so that on some items the Navy received only the one bid.

In the case of 2,000 aircrafts clocks the Admiral said it was impossible to get any bids under the act and it was necessary to buy under the open market provisions of the act to get around it. After enactment of the Walsh-Healey Act the number of bids on Navy contracts dropped from an average of 7.49 to a low of about three bids per lots in September 1939. However it rose thereafter to bring the average for fiscal 1940 to 5.03 bids per lot. The Admiral also complained that profit restrictions under the Vincent-Trammel Act had prevented needed expansion of plant by Navy suppliers.

FEW NEW MUNITIONS PLANTS

WASHINGTON—Less than half of the $850,000,000 available to the Army for government-financed munitions plants has been placed to contract. Plants announced to date are estimated to cost under $400,000,000. At least $50,000,000 in additional contracts are expected to come through rather promptly. Plans for considerable of the remaining $400,000,000 are in various stages of completion, with some of them yet to be started. Only one heavy gun plant contract has been let. More are to come, with the balance of the plants covering a wide range of munitions. The plans also cover provision only for 2,000,000 men with the Army thinking of the necessity for 4,000,000.

Assists at G-M *Manages AC Division* *New Personnel and Manufacturing Heads at G-M*



L. C. GOAD



GEORGE MANN, JR.



B. D. KUNKLE



F. O. TANNER

NAMES in the NEWS

W. V. C. Auser, former personnel director of Wright Aeronautical Corp., has been appointed to the newly created post of personnel director of Curtiss-Wright Corp.

A. H. Ferbert has been elected president of the Pittsburgh Steamship Co., U. S. Steel Corp. subsidiary, succeeding A. F. Harvey, who is retiring after 39 years of service with the company. The Pittsburgh Steamship Co. operates the lake ore-carrying fleet of the U. S. Steel Corp.

John F. Ditzell has been appointed general sales manager of Shafer Bearing Corp., Chicago. For a number of years Mr. Ditzell was a sales executive of the Stewart-Warner-Alemite Corp.

R. E. Doherty, president, Carnegie Institute of Technology, and Harry T. Woolson, executive engineer, the Chrysler Corporation, have been elected president and vice-chairman respectively of the Engineers' Council for Professional Development. George T. Seabury, secretary of the American Society of Civil Engineers, was elected secretary of the Council.

Robert M. Gaylord, president, Ingersoll Milling Machine Co., has been named president of the Illinois Manufacturers Association. O. M. Burton, Dixie Corp., and H. G. Myers, Gardner-Denver Co., have been named first and second vice-presidents respectively.

J. A. Ingwersen, formerly manager of Midwestern Sales, has been named manager of the Sheet and Strip Sales Division of the American Rolling Mill Co. F. E. Wortley succeeds Mr. Ingwersen.

M. L. Fawcett has been appointed staff assistant at the Westinghouse Electric & Mfg. Co.'s plant at Pittsburgh. J. K. Hodnette has been appointed manager of transformer engineering at the Sharon, Pa., works of the company.

B. D. Kunkle has been appointed vice-president in charge of personnel and F. O. Tanner has been appointed vice-president in charge of manufacturing of the General Motors Corp. W. C. Williams, Jr., another vice-presidential appointee, has been placed in charge of the accessory division. He is also a member of the administration committee.

L. C. Goad, general manager of the AC spark plug division at Flint, Mich., has been transferred to Detroit where he will act as assistant to Mr. Williams. George Mann, Jr., who has been associated with General Motors for 21 years, has been appointed general manager of the AC spark plug division to succeed Mr. Goad. Mr. Mann was formerly assistant secretary and director of industrial relations for the division.

S. M. Jenks has been appointed general superintendent of Gary works of the Carnegie-Illinois Steel Corp. Mr. Jenks succeeds E. E. Moore, who has been elected vice-president in charge of industrial relations.

Norbert K. Koebel, formerly metallurgist with Eastman Kodak Co., has been appointed research director for the Lindberg Engineering Co., Chicago. Ralph Stahl, formerly service engineer in the company's Chicago territory, has been appointed manager of the newly opened Lindberg office at Indianapolis, Ind.

A. B. Morey and C. K. Swafford have been elected vice-president and a member of the board of directors respectively, of the Gisholt Machine Co., Madison, Wis. Mr. Morey who formerly served as treasurer of the company, was succeeded by H. J. Homewood.

H. A. Scallen has been appointed district manager for the Hartford branch of the Jessop Steel Company, Washington, Pa. H. F. Robertson has been appointed sales representative for the company in the same territory.

Arthur B. Purvis, director-general of the British Purchasing Commission in the United States, has been made a Privy Councilor.

Harris E. Thorn has been appointed manager in Philadelphia of John A. Roebling's Sons Co. W. K. Hanna has been appointed manager of the company's Pittsburgh territory.

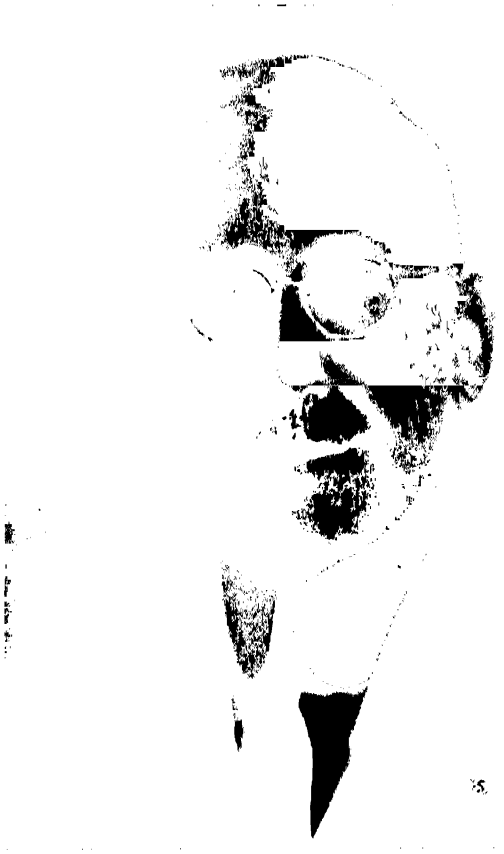
PLANT EXPANSION

Bethlehem Steel Corp., Los Angeles, has begun construction of several new buildings for its ship building division. The expansions, constructed at government expense, include machinery and equipment which will cost $2,756,000.

A. M. Byers Co., Pittsburgh, will soon begin the construction of added plant facilities. The expansion schedule will enlarge the company's activities to include the production of a broad line of alloy steels, including stainless.

Northrop Aircraft, Inc., Hawthorne, Calif., is erecting a new factory building, which will cover an area of 60x175 ft. will cost $21,000.

J. WALLACE CARREL DIES



J. WALLACE CARREL

J. Wallace Carrel, 73, vice president and general manager of Lodge & Shipley Machine Tool Co. since 1917, died recently at his home in Cincinnati. In point of service Mr. Carrel was one of the oldest men in the machine tool industry. On December 28 he would have completed 52 years in the business, for it was on that date, in 1888, that he went to work for the Lodge & Davis Co., Cincinnati

He was with this firm from 1888 to 1897, during the changes to the Lodge & Davis Machine Tool Co. and the Davis & Egan Machine Tool Co. At various times he served as manager of the New York store for Lodge & Davis, and as manager of the Cleveland store of Davis & Egan.

About this time Mr. Carrel joined forces with Charles E Billin & Co. until 1898, when he went with Hill, Clarke & Co, Boston. He remained there until 1902, when he was elected president of Draper Machine Tool Co.

In 1908 AMERICAN MACHINIST wanted a man to tour Europe and study industrial conditions and shop methods. It wanted a man who had the full confidence of industry, and selected J. Wallace Carrel. On his return from Europe he became general sales manager of Lodge & Shipley Machine Tool Co.

OBITUARIES



ALVIN IRWIN FINDLEY

Alvin Irwin Findley, editor of *The Iron Age* for 20 years prior to his retirement in 1930, died recently at his home in St. Petersburg, Fla. He had spent 50 years in journalism, 38 of them in the field of business journalism. He spent his early days in Akron, Ohio, and went into newspaper work. He was editor of *Iron Trade Review* (now known as *Steel*) for seven years prior to becoming associated with *The Iron Age*. He was the first president of the National Conference of Business Paper Editors.

Carl Ludwig Grohmann, formerly chief engineer of the Pratt & Whitney Div., Niles-Bement-Pond Co, West Hartford, Conn, died two weeks ago Mr. Grohmann who was 79 years old, was a member of the American Society of Mechanical Engineers.

Charles J Reinbolt, 65, formerly shop foreman of the A. F. Oliver Gear & Machine Co, Buffalo, died recently. Mr Reinbolt had been employed by the company since its organization 25 years ago.

Marshall Williams, 67, a former official of the American Bridge Co., Pittsburgh, died recently.

Mall Tool Co., Chicago, has doubled its plant area by the purchase of a building and land from Republic Steel Corp., near its present plant. About $100,000 worth of new equipment has been ordered for the 50,000 sq.ft. of additional floor space.

Anacapa Aircraft Corp., Santa Paula, Calif., has begun construction of a new factory for the manufacture of primary and basic training planes.

The Champion Spark Plug Co., Toledo, has let a $70,000 contract for expansion of its plant.

Foote-Burt Co., Cleveland, has purchased the Hammond Manufacturing Co, maker of sensitive radial drills and surface grinders. The Hammond Company was organized in 1916 by officials of Strong, Carlisle and Hammond Co., who have operated it since.

Aluminum Industries, Inc., Cincinnati, has started construction of a new plant unit containing 150,000 sq.ft. of floor space. When the foundry is completed, the company will begin construction of shop for machine operations which will total 300,000 sq.ft. of space.

MEETINGS

Society of Automotive Engineers. Annual meeting, and engineering display. Book-Cadillac Hotel, Detroit, Mich., Jan. 6-10, 1941.

Machine and Tool Progress Exhibition. Sponsored by the American Society of Tool Engineers. Convention Hall, Detroit, Mich., March 25-29.

SHOP EQUIPMENT NEWS

Murchey Single and Double Spindle Machines Designed to Tap and Chamfer Nose End of Shell

Murchey Machine & Tool Co, 951 Porter St, Detroit, Mich, has announced a series of single and double spindle machines especially designed to tap and chamfer the nose end of shell Illustrated is a double spindle machine arranged with leadscrews to tap and chamfer 45 Naval HE shell

Special shell holding fixtures include hardened and ground pads which locate the shell within a few thousandths of concentricity with the spindle These pads may be changed for various shell sizes After the shell is approximately located it is picked up by an air-actuated female center, which forces the shell forward until the nose end is firmly held in a hardened and ground serrated bushing This bushing supports the shell rigidly in alignment for tapping and chamfering It may be changed to accommodate shell of different contour or size Female center and length of stroke of air cylinder can likewise be changed for various types of shell

Machine spindles are equipped with Murchey Type M hardened and ground collapsible taps which include four reaming tools as well as four chasers The taps are actuated by yokes operating between adjustable stops which trip the taps to predetermined positive thread length and reset the taps for the next operation

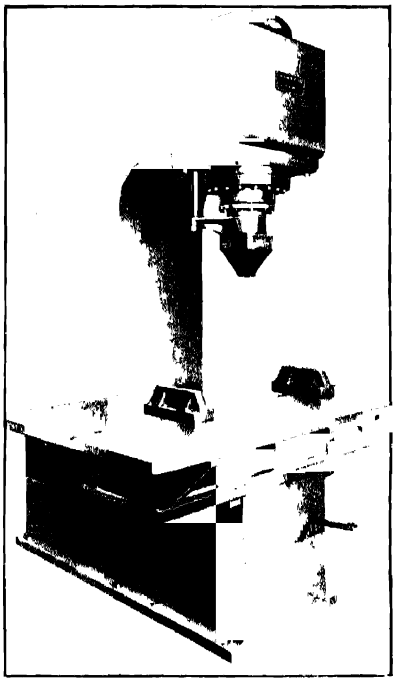
Sequence of operations is to chamfer the shell with the tap chasers collapsed and with the lead screws disengaged The carriages are then returned, automatically expanding the chasers for the tapping operation the lead screw is thrown in and the shell is tapped in perfect alignment and with accurate lead By completing tapping and chamfering in the same spindle, concentricity is maintained and a separate chamfering operation is avoided

Hannifin Straightening Press Has Capacity of 150 Tons

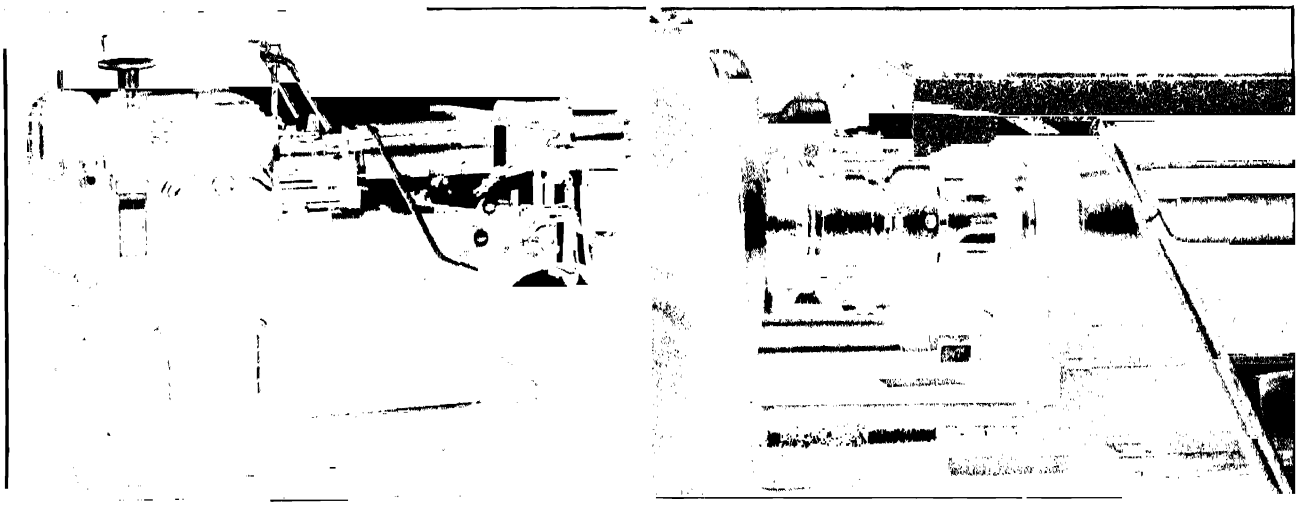
This 150-ton straightening press, built by Hannifin Mfg Co 621-631 S Kolmar Ave Chicago Ill is provided with a large table to facilitate straightening steel castings and similar work Press base is designed for installation below floor level to bring the table to a convenient height for easy handling of bulky pieces

Sensitive pressure control is used promoting simple and accurate handling This type of control allows unusually rapid handling of straightening operations with finger-tip or light foot pedal control of ram movement and ram pressure Ram movement both up and down and pressure control are accomplished by operation of a single hand lever or foot pedal

Initial movement of the control lever causes the ram to move down rapidly at nominal pressure The ram descends until it touches the work and then stops Movement of the control lever beyond the approach position causes the ram to exert pressure proportional to the distance the control lever is moved Any required ram pressure up to the capacity of the press is obtained merely by moving the control lever Releasing the lever at any point automatically returns the ram to top position with a high-speed return stroke



The motor-driven hydraulic power unit is built into the press base Frame is welded and all piping is concealed Dimensions stroke 20 in, gap 30 in, reach 30 in Table measures 54x96 in





"Char-Mo" Atmosphere Furnace Used for Tool Tip Brazing

Brazing of cemented carbide tool tips to shanks is one of the outstanding uses of the "Char-Mo" atmosphere furnace developed by Surface Combustion Corp., Toledo, Ohio. This controlled-atmosphere furnace maintains absolute surface cleanliness without decarburization of high-carbon shanks.

"Char-Mo" atmosphere, developed a few years ago for heat-treating high-carbon and alloy steels without scale or decarburization, is produced from charcoal in a self-contained generator This atmosphere is approximately 2 3 nitrogen and 1 3 carbon monoxide, with only infinitesimal traces of water vapor and carbon dioxide. Since the only combustible is slow-burning carbon monoxide which is diluted with two parts of nitrogen, the possibility of an explosion is practically nil

Generator, which requires no separate heating, consists of a refractory tube which passes vertically through the furnace between the muffle and furnace wall. The tube top is above the furnace and is connected to a charcoal hopper. The bottom is below the furnace, connected to a simple ash remover. Air (from the same blower used to supply combustion air to the burners) is introduced near the bottom of the tube As the air rises through the tube it reacts with the incandescent charcoal and forms a gas ideally suited for brazing.

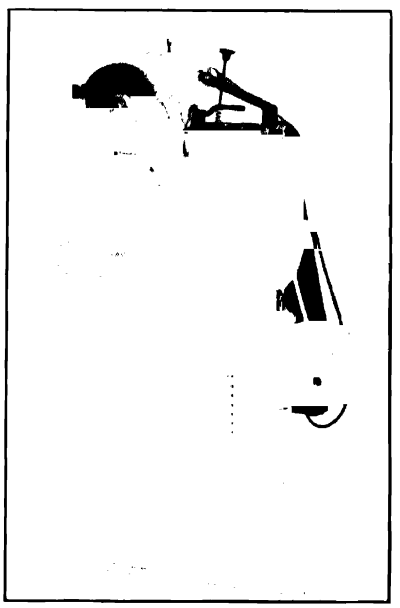
Furnace proper is gas-fired and consists of a preheat zone, a heating or brazing zone, and a cooling zone. Preheat zone is also equipped with burners, used when starting or running heavy loads. Cooling zone is water jacketed for rapid cooling. The protective "Char-Mo" gas is introduced into all three chambers.

Tools are placed on open trays and manually pushed through the furnace. Loading and unloading takes place through side doors. The furnace produces an average of 2,000 pieces per 16 hr. The cycle is 1½ hr., consisting of 15 min. preheat, 5 min. braze, and 70 min. cooling. Amount of charcoal used is 50 lb. per 16 hr.

Wardwell Saw Grinder Indexes Work Automatically

The No 57T automatic metal saw grinder offered by Wardwell Mfg. Co., 3167 Fulton Rd., Cleveland, Ohio, was designed especially for sharpening form milling cutters, slitting and screw slotting saws in gangs in one setting. The machine automatically indexes the gang of saws, one row of teeth at a time, with the grinding wheel shaped to suit the tooth gullet.

This machine is claimed to be capable of sharpening a gang of saws with a variation of plus or minus 0.001 in. of exact diameter for the entire lot. A group of 250 saws, 0.015 in. in thickness, can be sharpened at one time. Of durable, accurate construction, this machine is equipped for either wet or dry grinding. It handles work from 2 to 8 in. in diameter and in gangs up to 3¼ in. in thickness with tooth spacing up to 1¼ in. Weight of the pedestal type is approximately 625 lb; weight of the bench-type is about 500 lb.



Special Landis Machine Performs Multiple Operations

Landis Machine Co., Waynesboro, Pa., has developed a recessing, boring and tapping machine which is designed to finish completely the internal or tapped ends of integral joint type casing at one chucking. Similar to the mill type receding chaser pipe threading and cutting-off machine, this device employs a special carriage on which are mounted recessing, boring and tapping tools.

In effecting this arrangement, three tool slides are mounted on a cross slide which can be indexed to bring any one of the tool slides into working position. One tool slide finishes the recess, faces the end of the casing, and chamfers three surfaces in the end. A second tool slide finishes the taper bore preparatory to tapping. The third slide is a special receding chaser collapsible tap arranged to chase the internal thread using the leadscrew mechanism built into the machine.

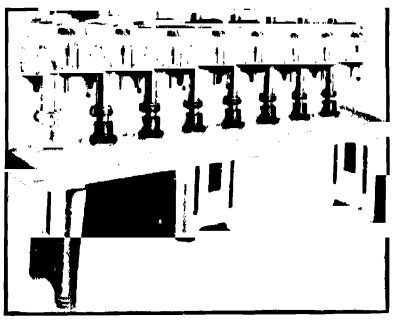


All movements of tool slides as well as those of the cross slide are hydraulically controlled, with the circuits arranged with interlocks to assure correct operating sequence. The cross slide is hydraulically locked into position when any of the tool slides is in action. Controls are conveniently centralized on a panel at the front of the machine, providing the operator full control from a position permitting observation of the tool during machining

Sectional Drill Press Is Developed by Delta

Delta Mfg Co., 620 E. Vienna Ave., Milwaukee, Wis., has developed a sectional drill press which permits the user to make up his own drill presses to fit exact needs. By using these sectional drill press production tables it is possible to build up drill presses with from one to an indefinite number of spindles—all 14 in. or all 17 in. or any combination of both—with the drilling heads spaced to fit individual requirements.

Each table section measures 22¾ in. deep by 30 in. wide (with ends 35 in. wide) with room for two spindles, providing a minimum center-to-center distance of 15 in. Tables are accurately ground and fitted.

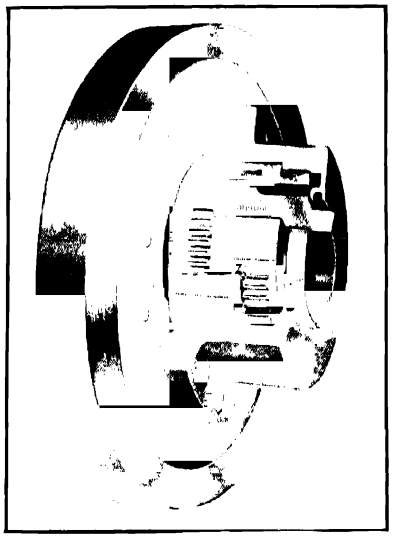


Farrel-Birmingham Offers "Manger" Flexible Coupling

Designed to save space and at the same time secure full flexibility, the 'Manger" flexible coupling has been developed by Farrel-Birmingham Co, Buffalo, N Y This coupling provides complete flexibility with approximately one-half the axial clearance usually required A dummy, pilot or stub shaft generally necessary with other types is eliminated Coupling is equally applicable for connecting two free-ended shafts in combination with a solid flanged half coupling which gives a close-coupled connection

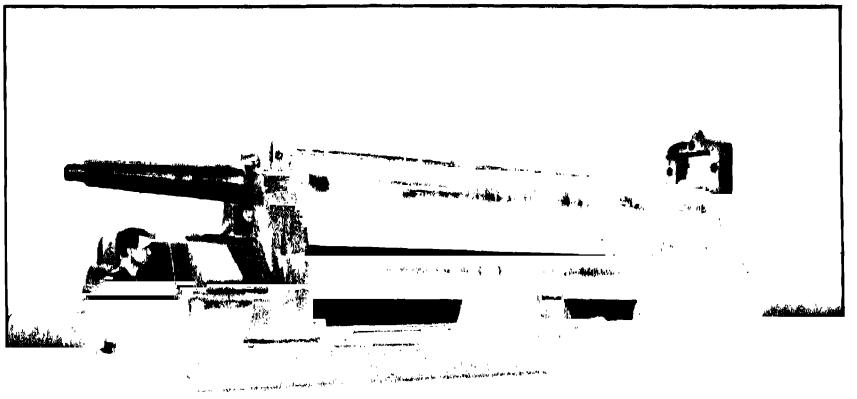
In connecting shafts of different diameters the coupling is mounted on the smaller shaft and bolted to a half coupling on the larger shaft Since the size of the flexible member is determined by the size of the smaller shaft a smaller coupling can be used

Compensation for misalignment is made by an internal sleeve which floats between an externally geared



hub and an internally geared covering sleeve The internal sleeve which engages the hub and outer sleeve is free to slide and rock adjusting for differences in alignment The driving member of the coupling can be either the geared hub or the covering sleeve

Gear teeth are accurately generated on Farrel-Sykes machines External teeth are crowned which gives full freedom to the floating sleeve within the design limits of the coupling Compensation is provided for offset, angular and combined misalignment without resistance to free lateral float of the connected shafts Contact areas are large, and heavy oil lubricating the contact surfaces provides a cushion against shock without the necessity of using flexible materials



16-Ft. Baldwin-Southwark Bending Roll Uses Welded Construction for Simplicity

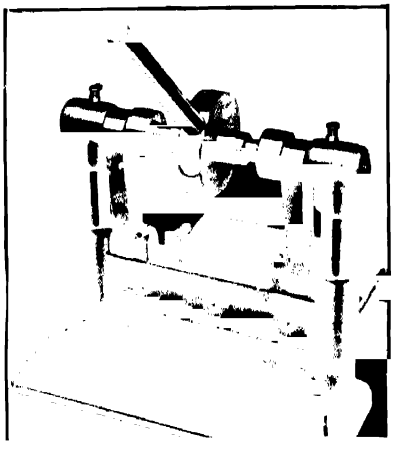
Simplification of design through use of welded construction is achieved in the 16-ft horizontal bending roll built by Baldwin Southwark Div Baldwin Locomotive Works Philadelphia Pa This roll provides greater rigidity and better load distribution at the several joints between the drive box bed rails and inner housing by welding these parts as an integral unit

Drive gears are arranged to minimize twisting moments set up in this region Oil-tight boxes bolted to the frame contain nuts and gears for screwing down the top roll Conical shapes can be rolled by raising one end of the top roll The two control levers shown in the left foreground operate clutches which permit either end of this roll to be raised or lowered independently

Cylinders and shapes which must be removed from the machine in a direction parallel to the axis of the rolls are readily handled because of the use of a drop-end housing Balance bar at the left of the top roll is engaged to support it in a horizontal position while the right housing is lowered to clear that end A light shop crane can be used for handling this housing or hydropneumatic operation can be furnished which provides considerably greater speed and convenience

"Micro" Bench Shear Cuts Medium-Weight Sheet

Intended for work between the heavy floor type foot operated shear and the small thumb and finger operated tinsmith's shear the Micro bench shear built by O Neil-Irwin Mfg Co,



316 Eighth Ave S Minneapolis, Minn can be set for accurately trimming metal stampings for die duplicating work and for shearing material to die duplicating size from stock sheets

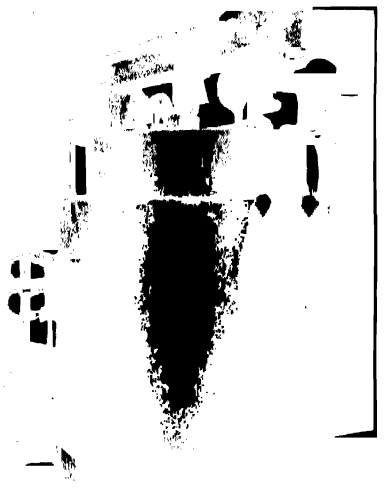
Design of the shear permits close observation of work at all times The working table can be drilled and tapped for precision gages for die substitute and semi-production work It is made of steel plate and can be replaced from stock material when required Material guides provide for accurate shearing to within less than 0 001 in

Design of this tool allows circular and irregular material to be sheared where only a part of the piece is to be trimmed Interfering material may be left free of the blade by cutting from around the ends of the shear Clearance between shearing blade can be adjusted Maximum shearing width is 6¼ in , maximum shearing capacity is 24 gage steel plate full width and 18 gage steel plate of 1-in width

General Electric Develops Gas Carburizing Furnace

A gas-carburizing electric furnace for case-hardening steel parts has been announced by General Electric Co, Schenectady, N Y This furnace is claimed to offer outstanding advantages over other methods of carburization A hydrocarbon gas, circulated rapidly through the charge, is used instead of a solid carbon compound as a source of carbon Since the gas is uniformly distributed in the furnace, a case of uniform thickness forms on every surface, regardless of position in the load In addition, the furnace can be controlled automatically to reproduce any carburizing treatment, time after time, on a production-line basis

Operating data are said to show that savings as high as 75 and 80 per cent are made under some conditions when this gas-carburizing furnace is substituted for older methods

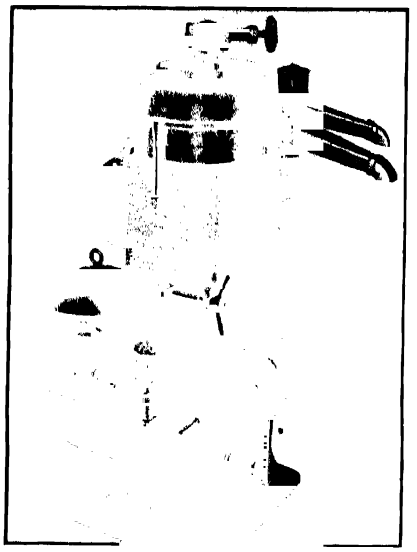


of carburizing These savings are possible because of the shortened carburizing cycle, elimination of packing material and improvement in quality and uniformity of carburized parts

Propane gas is passed into the chamber through an inlet in the bottom of the retort at the periphery of the circulating fan The amount of carbon in the furnace is controlled by regulation of the gas flow The fan, which is made of heat-resisting alloy is driven by an easily accessible standard induction motor Rapid circulation of the gas assures quick heating and uniform temperature distribution

National Acme Centrifuge Adaptable to Many Uses

The No. C-1 positive universal centrifuge developed by National Acme Co, 170 E. 131st St, Cleveland, Ohio, accommodates a variety of bowls and

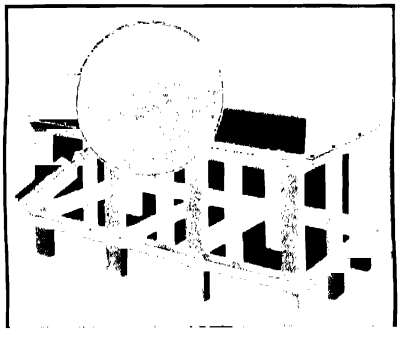


is especially suited to shops using considerable quantities of cutting, lubricating hydraulic or soluble oils Available with single or double inner cylinder, wing impeller, enamel spider and special filter, this device is said to save oil, protect bearings and increase tool life It is claimed to be ideal for installation in built-in oil reconditioning systems

Challenge Lapping Plate Has 1-16 Inch Grooves

To provide for accurate lapping of delicate joints, Challenge Machinery Co, Grand Haven Mich has designed a semi-steel lapping plate having $\frac{1}{16}$-in grooves spaced $\frac{1}{2}$ in apart, running the full length and width of the surface Joints required to hold oil can be properly lapped with this plate which is specifically designed to assure a perfect fit when lapping in metal-to-metal joints on which no gasket, shellac or sealer of any kind is used

A specially designed all-steel stand is available with these lapping plates It is arc-welded for rigidity and strength and is equipped with closely spaced lock leveling screws to enable the user to keep the plate level at all times Plates are built in a wide variety of standard sizes, ranging from 8x8 to 52x144 in Special sizes are built to order

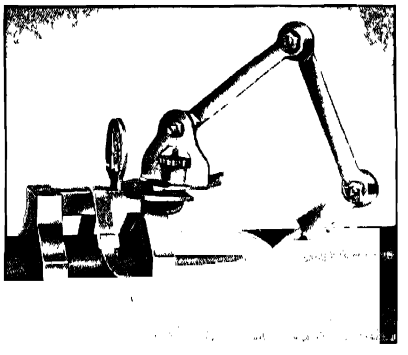


"Trumark Junior" Pretractor Makes Accurate Layouts

Accurate layouts for any angle cut on round surfaces are possible with the "Trumark Junior" protractor developed by Tru-Line Corp., 6022 Wilshire Blvd, Los Angeles, Calif Time and material are saved through accurate cuts made without templets or involved calculations

On any rectangular form, the instrument is held squared to the edge or corner, the desired angle is set on the protractor scale, and the line marked The mark goes completely around T or channel shapes For machining the forward edge, the instrument shows the exact angle of any cut, or can be used as a marking edge on small cuts

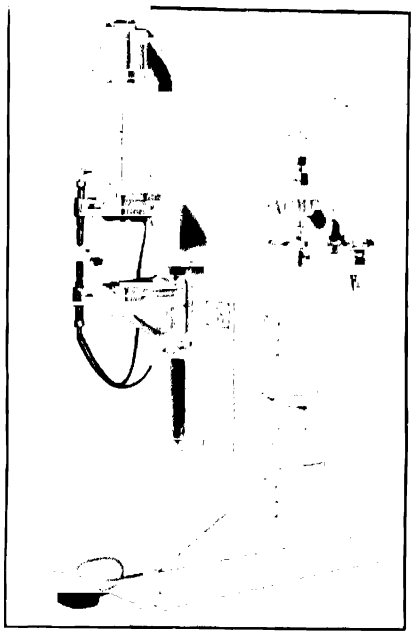
For marking pipe, the "Trumark" is firmly held in place by a strap Two levels show exact position for the instrument The desired angle is set on the 180-deg scale and the flexible marking arm then scribes a line completely around the pipe The device is all die cast, with marking arms held in position by fiber disks



More Fluorescent Lamps Announced by General Electric

The Lamp Department of General Electric Co Nela Park Cleveland Ohio, has brought out three new fluorescent lamps One is a 100-watt 60-in lamp, another is a 6-watt 9-in lamp, and the third is a Soft-White lamp made in several sizes

The 100-watt lamp employs a T-17 tubular bulb measuring $2\frac{1}{8}$ in in diameter It is designed for general lighting needs, and produces more than double the amount of light given off by the standard 40-watt 3500 F white fluorescent lamp, with only a slight increase in surface brightness The 6-watt lamp employs a T-5 round bulb and miniature bipin base This lamp of daylight and 3500 F white permits use of fluorescents in many places where larger lamps are not practical The new soft-white lamps come in 15, 20 30, and 40-watt sizes and in 18, 24, 36 and 48-in lengths The 15 and 30-watt sizes have T-8 bulbs; the 20 and 40-watt sizes have T-12 bulbs



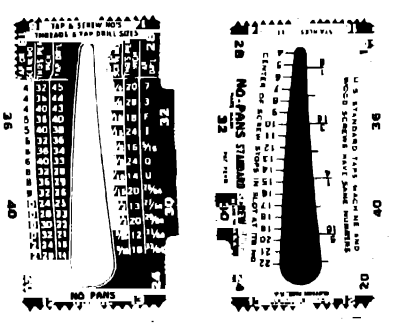
Acme "Hot Spot" Welder Is Operated by Air

Type PT-1 air-operated spot welder is manufactured by Acme Electric Welder Co., 5621 Pacific Blvd, Huntington Park, Calif., in capacities from 30 to 150 kva. In the smaller capacity welders throat depths are available from 12 to 30 in, while in the larger capacities throats range from 12 to 48 in. Eight steps of heat regulation are standard, but up to 32 steps can be supplied.

Base is of all-welded steel construction. Features include water cooling of secondary, column and electrodes, universal double end reversible horns, positive-locking heat switch, and complete air equipment.

Standard Screw Gage Made Available by No-Pans

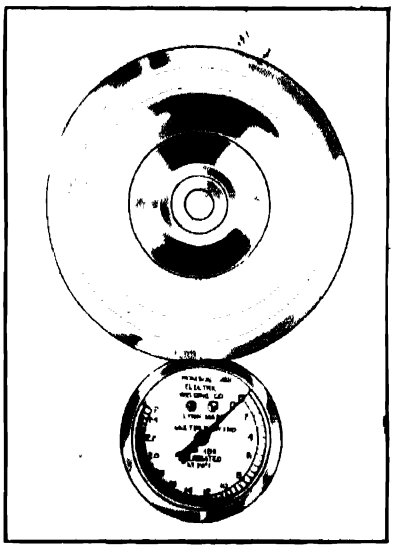
No-Pans Washer Co., 383 Nelson Ave., Cliffside Park, N. J., has developed a standard screw gage which gives screw sizes for machine screws from No. 4 to No. 22 and for wood screws from ⅛ to ⅜ in This tool also gives 12 machine screw threads and 29 tap holes to drill for machine screws. Made of stainless steel, the device measures 2½ x 1½ in.



Improved Thomson Meter Measures Welding Pressures

Improvements in the design of the resistance welding pressure meter developed by Thomson-Gibb Electric Welding Co., 164 Pleasant St., Lynn, Mass., insure greater precision, permanent accuracy and a wider selection of calibrations. Meter consists of an oil-filled diaphragm connected to a gage made with a bronze-bushed movement. Dial is calibrated to read directly in pounds. A plunger tube plug stabilizer in the stem protects the gage against damage from sudden application of pressure, and eliminates danger of the needle being forced off the scale or turned on its shaft.

The diaphragm unit is resistance welded throughout, the pads being welded to the diaphragm plates which are seam welded together. The stud into which the gage is screwed is welded to the diaphragm. Gages are available in capacities up to 350,



550, 800, 1600, 2500, 4000, 5000 and 6000 lb. They are chromium plated, have beveled glass faces and are individually packed in wooden boxes.

"Protexteel" Metal Coating Defies Abuse and Corrosion

"Protexteel," developed by Watson-Standard Co, 225 Galveston Ave., Pittsburgh, Pa., is claimed to dry hard in any weather, resist abrasion and abuse, and to defy corrosion Consisting of a primer and finish coat, these compounds arrest corrosion by zinc chromate pigments, and afford lasting protection with a Bakelite varnish. Finish coat is said to provide a long-lasting, highly elastic and extremely durable surface strongly resistant to abrasion, even under handling and erecting processes.



Atlas Milling Machine Handles Smaller Work

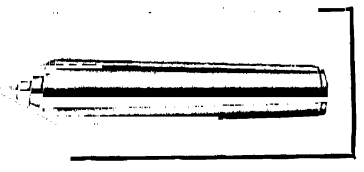
The bench milling machine built by Atlas Press Co., Kalamazoo, Mich, has been designed for improved efficiency, versatility and economy on small piece milling. This tool handles the full range of milling operations from heavy slabbing and facing to light end milling, keyways, finishing and layout work.

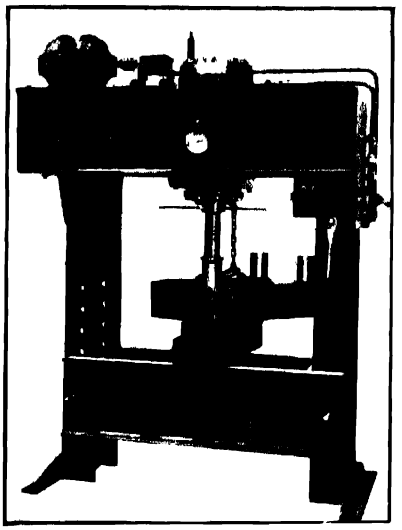
In this machine three types of table controls are available: standard screw feed, rapid-production lever feed, and "Changeomatic" feed for instant selection of automatic table feeds. A wide range of spindle speeds provides correct surface speeds for all types of work and cutters. Swivel vise, rotary index table, indexing centers, and coolant system are available.

Specifications: table working surface, 4½x18 in.; longitudinal table travel, 12 in. (10 in. with "Changeomatic" feed); vertical table travel, 6 in.; approximate over-all dimensions, 25½x32½x22 in

Grooved Lathe Center Improves Work Lubrication

It is claimed that work turned between centers need never be relubricated when the Type CMD helical groove lathe center is used in the tailstock This lathe center, offered by Chicago Mfg. & Distributing Co., 1928 W. 46th St., Chicago, Ill., holds an ample supply of lubricant and permits it to flow down where it will do the most good. Left-hand grooves prevent excess lubricant from dripping or being forced out of the work by rotation. Center is available in sizes from No. 0 to No. 6.



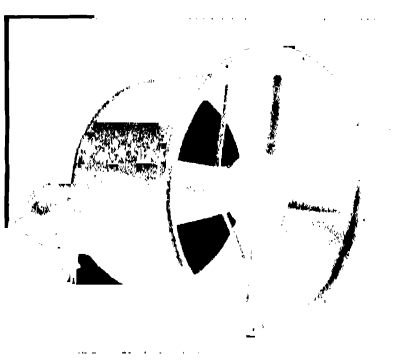


Elmes Hydraulic Press Handles General Work

A large volume and wide variety of general shop work can be handled efficiently with the hydraulic press developed by Charles F. Elmes Engineering Works, 230 N. Morgan St., Chicago, Ill. With a 12-in. screw adjustment and a 12-in. ram stroke, this model has a total stroke of 24 in. Platen is adjustable by means of a ratchet gear. Control is by a single lever. Maximum accessibility during operation is obtained by a simple frame of all-welded steel Capacities and sizes to suit nearly all requirements are available, beginning with a model powered by 1½-hp motor.

Paint Spray Booth Fan Developed by DeBothezat

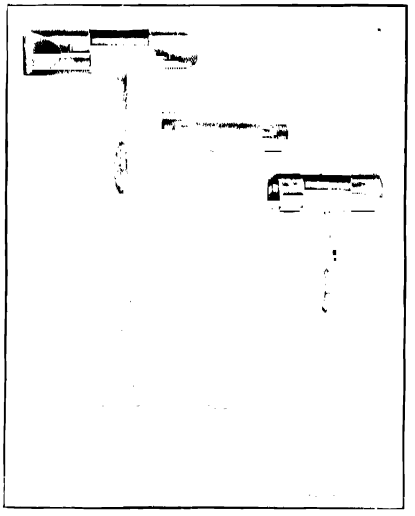
A paint spray booth fan placed on the market by DeBothezat Ventilating Equipment Div, American Machine & Metals, Inc, East Moline, Ill., assures protection against hazards of spray painting under all operating conditions. Built to Underwriters' specifications, this fan is corrosion-resisting and non-sparking Motor is substantially mounted and balanced outside the fan housing on an adjustable base, and power is transmitted by V-belts through a vapor-proof drive chamber. Fan wheels are of die-formed aluminum, with blades readily removable



Bonney Forge & Tool Works Offers Soft Face Hammers

Five additional types have been added to the line of soft face hammers made by Bonney Forge & Tool Works, Allentown, Pa. The new types and sizes are especially useful where a hammer is required that will not mar finely finished surfaces or delicate machine parts. They are also useful for forming and working light sheet metal.

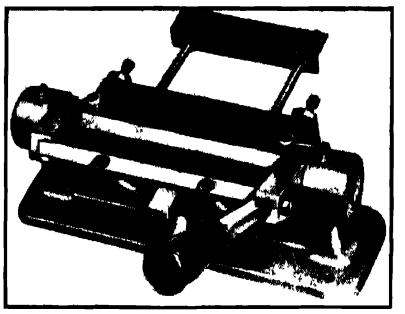
Hammers are available with one regular face tip and one ball pein tip; with one straight pein tip and one cross pein tip; with two ball pein tips; with one square tip and one offset pein tip; with two regular face tips and with one regular face tip, and one regular face tip with brass insert. All tips are renewable. They are made of a tough, amber colored, cellulose composition that will not shatter or chip. Hickory handles have comfortable grip and are securely wedged in the steel center body. Head weights range from 1½ oz. to 2 lb.



Sheet and Strip Formed With "Micro" Bench Brake

O'Neil-Irwin Mfg Co, 316 Eighth Ave. S, Minneapolis, Minn, has developed the "Micro" bench brake for precision forming of angles and channels from sheet and strip stock This tool will handle materials in sizes from $\frac{1}{8}$ in up. It will also form angles, brackets, vees and other types of folding to 110 deg.

Folding operations are completely visible, allowing the operator full control. Horizontal and vertical adjustment of the folding plate is provided for accurate setting to form either acute or obtuse angles. Accurate folding stops are provided for duplicating all operations to within 0 001 in. Material guides can be quickly adjusted for accurate metal duplicating, and rapid folding of sheet material on a semi-production basis. Maximum folding width is 6 in. Maximum folding capacity, full width, is 18 gage steel plate. Maximum folding capacity, 4 in. width, is 16 gage steel plate.



Oil-Immersed Starter Features Better Protection

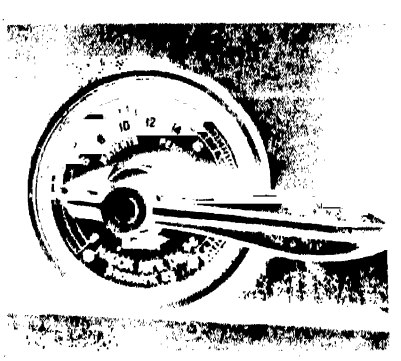
General Electric Co., Schenectady, N. Y., has developed an oil-immersed combination starter for use in corrosive or hazardous gas locations The device is available with or without a circuit breaker.

To facilitate installation, a one-piece cast-iron head, used in both forms, permits conduit entrance from five directions. As protection against external corrosion, stainless steel and Monel metal are used for all exposed parts. Copper-bearing steel tank and cast-iron head provide additional protection. Reversible tips prolong contact life, and protection against harmful overloads is supplied by an isothermic induction-temperature relay immersed in the oil.

"Micro-Cam" Oil Valve Has Straight-Line Flow

Flow is directly proportional to the area of the slot opening and to the number on the calibrated dial in the "Micro-Cam" oil valve developed by Hauck Mfg Co, 124 Tenth St Brooklyn, N Y This instrument is claimed to take guess work and uncertainty out of regulating oil flow on any type of burner

Flow of oil is governed by a cam with a knife edge rotating against a V-slot in a flat plane Operator can easily repeat the previously determined settings with full assurance of duplicating results. Concentrated free opening minimizes clogging.



DELIVERIES

ARE

WITHIN REASON

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NEW "RAPIDUCTION" LATHE

OSTER



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2049 EAST SIXTY-FIRST PLACE

CLEVELAND, OHIO, U.S.A.



Westinghouse Induction Motors Are Lighter and Smaller

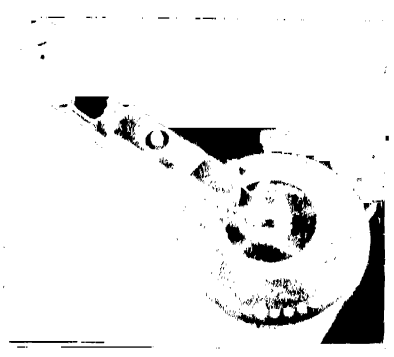
Type CS sleeve-bearing squirrel-cage induction motors have been designed especially for general purpose applications such as machine tools, pumps, and auxiliary drives by Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa. These motors are available in ratings from ½ to 5 hp., at speeds from 875 to 3600 r.p.m. for operation on 110, 220, 440, and 550 volts, 2 and 3 phase.

More attractive and compact, the motors are also stronger mechanically. Rigid complete cast frames maintain constant air-gap between stator and rotor, assuring high efficiency. Frame improvements include new sealed sleeve bearings having a combination vestibule and felt washer seal, and a larger oil reservoir capacity. Oil filler cups may be inserted on either side of the motor.

New wire insulation gives maximum dielectric strength, toughness, and flexibility. Combination slot cells, with reinforced cuffs, protect windings from abrasion, and coil ends are taped for reinforcement against strains of full voltage starting. All motors are dynamically balanced, and windings are given a high-voltage radio frequency test.

"Micro" Duplicating Bender Forms Parts Accurately

In many cases the expense of making dies or die sets can be eliminated by the use of the "Micro" die duplicating bender made by O'Neil-Irwin Mfg. Co., 316 Eighth Ave. S., Minneapolis, Minn. This tool is also said to bend metal pieces to shapes which are impractical, or in some cases impossible to obtain with blanking or forming dies.

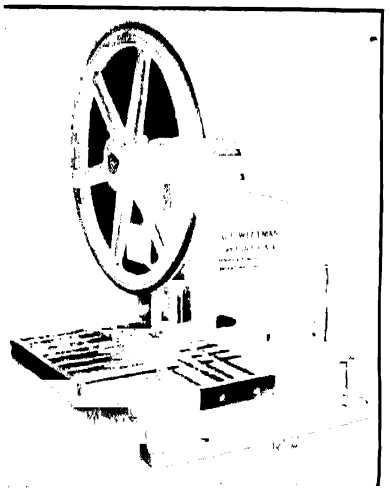


Range of contour bending and die duplicating operations is limited only by the expansion and contraction limits of the material. The tool will receive without alteration simple conversions for forming angle, channel, rod, round or square tube. Half-rounds or flat wire and strip can be bent on edge.

Conversions are quickly made from regular stock materials with simple lathe and hand tools. Work can be held to tolerances not exceeding 0.001 in. Stops may be set and material guides mounted for semi-production work up to 1,000 operations per hour.

Improved Spacing Machine Provides for Short Runs

Recommended especially for experimental work and short-run production is the improved spacing machine offered by G. F. Wittman Co.,



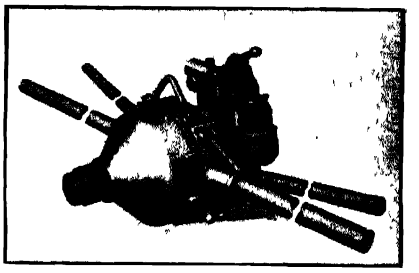
20 Northwood Ave., Dayton, Ohio. Two styles of this machine are available—the spacers and follow-up presses. Follow-up presses are the same in construction as the spacing machine, with the exception that the spacing plate is removed and a different type stripper is used.

Outstanding advantages of this improvement are ease of operation and quick change-over for short-run production lots. This is claimed to reduce greatly the cost of experimental parts and limited production lots.

Specifications: Punching capacity, 15,000 lb.; throat, 8 in.; stroke, ½ in.; weight, 370 lb.

"Multi-Vane" Motor Used In Flue Rolling Machines

Identified as Nos. 55-Q and 55-R, two flue rolling machines introduced by Ingersoll-Rand Co., Phillipsburg, N. J., are powered by "Multi-Vane"



air motors. These machines have been built for rolling extra large tubes such as used in oil refinery stills, for tapping, running in and removing large pipe plugs, for tapping flue sheets in large boilers, and for heavy reaming, such as in propeller shaft couplings.

Working speeds are very low, with correspondingly high torque. Size 55-Q has an average working speed of 32 r.p.m. Size 55-R has an average working speed of 20 r.p.m., and about 50 per cent greater torque than the 55-Q model.

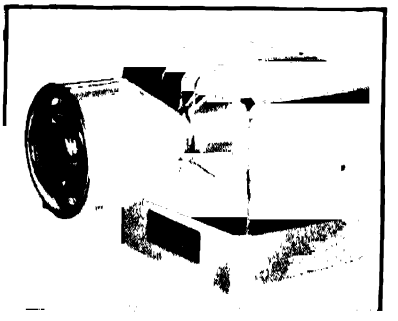
"Bradex" Fixture Cleaner Offered by Bradley Washfountain

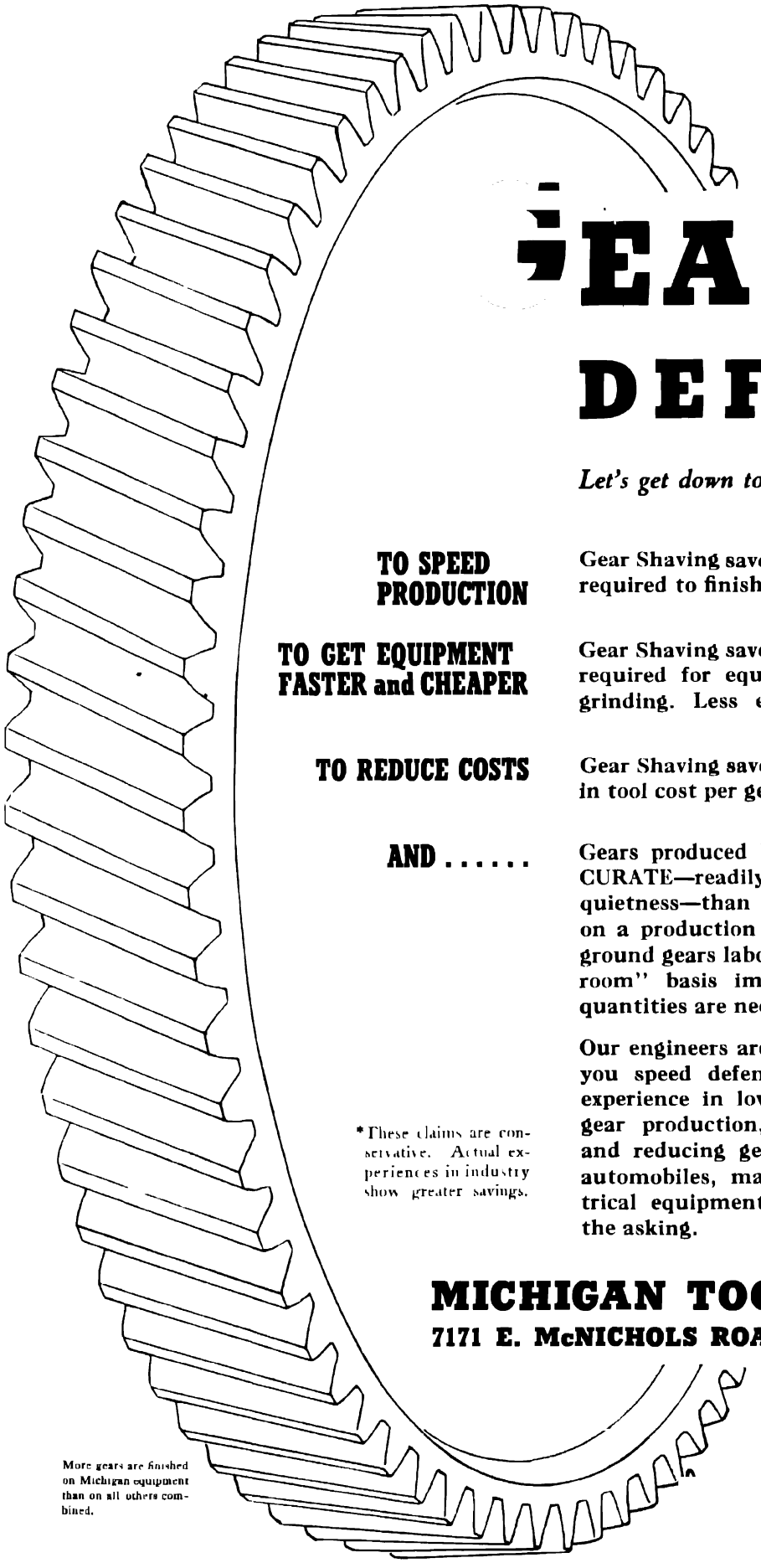
Bradley Washfountain Co., N. 22nd & W. Michigan Sts., Milwaukee, Wis., has developed "Bradex" cleaning agent especially for washfountains, multi-stall showers and drinking fountains. This compound, which can be used on all washroom facilities, is claimed to be economical, safe, easy to use and highly effective.

G.E. Photoelectric Relay Made for Many Applications

General Electric Co., Schenectady, N. Y., has developed a compact photoelectric relay for a wide variety of general-purpose applications. This relay operates at speeds up to 150 interruptions per minute and at a minimum of 40 foot-candles at the phototube with not more than 15 foot-candles of extraneous light.

Applications include counting, sorting, weighing, measuring, controlling, signalling, inspecting and regulating. The relay has a controlled contact rating of 10 amp. at 115 volts a.c., with two normally open and two normally closed contacts. Relay coil is energized when the light at the phototube falls below 30 foot-candles.





GEARS *for* DEFENSE

Let's get down to earth. Here are the facts:

TO SPEED PRODUCTION

Gear Shaving saves 4 months out of every 5* required to finish gears by grinding.

TO GET EQUIPMENT FASTER and CHEAPER

Gear Shaving saves 5 dollars out of every 6* required for equipment to finish gears by grinding. Less equipment—faster delivery.

TO REDUCE COSTS

Gear Shaving saves 7 dollars out of every 8* in tool cost per gear compared with grinding.

AND . . . . . .

Gears produced by shaving are MORE ACCURATE—readily proven by their greater quietness—than those produced by grinding on a production basis. (Excepting of course ground gears laboriously produced on a "tool room" basis impossible where production quantities are needed.)

Our engineers are ready and anxious to help you speed defense gear production. Their experience in lowering gear costs, speeding gear production, improving gear accuracy and reducing gear failure for producers of automobiles, machine tools, tractors, electrical equipment, trucks, etc. is yours for the asking.

*These claims are conservative. Actual experiences in industry show greater savings.

MICHIGAN TOOL COMPANY
7171 E. McNICHOLS ROAD DETROIT

More gears are finished on Michigan equipment than on all others combined.



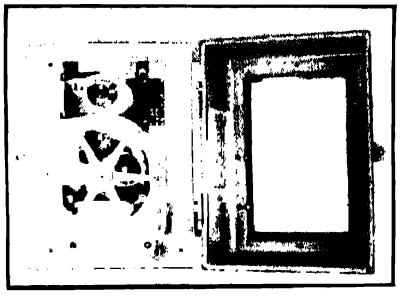
Ohio Gear Speed Reducer Handles Fractional Horsepower

The BHU speed reducer developed by Ohio Gear Co., E. 179th St. & St. Clair Ave., Cleveland, Ohio, is offered in three assemblies with output shaft projecting to right, to left or to both right and left. Only 5¾ in. long, 3 in. wide and 5⅝ in. high, this fractional-horsepower reducer is available in stock ratios between 10:1 and 48:1. A bronze worm wheel and a hardened and ground worm operate in Timken roller bearings. Torque capacity is 150 in.-lb.

Cramer Program Switch Features Extreme Precision

The synchronous motor-driven automatic program switch offered by R. W. Cramer Co., Centerbrook, Conn., can be pre-set to close an electrical circuit for from 5 to 25 seconds, precisely at any 5-minute intervals of the 24 hours. The machine will handle up to 30 operations per day.

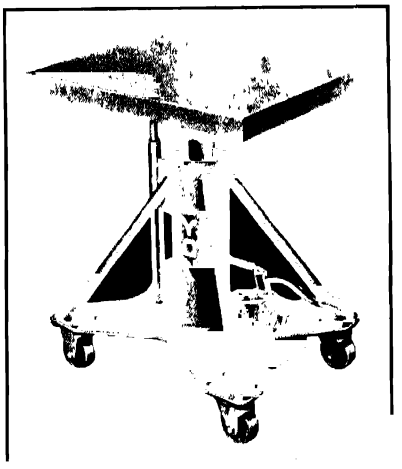
The 5-minute dial is divided into minutes, halves and twelfths. Setting this dial on time sets all other dials. It can be set accurately to the second and since the main contact is actuated by a double cam integral with this dial, switching is as accurate as the setting. A 60-minute hand serves for ready time checking, in relation to both the 5-minute and the 24-hour dials. The 24-hour dial serves as the program wheel. It has a threaded hole for each 5-minute interval. Pins screwed into the appropriate holes determine signalling and switching program. Device is easy to set and easy to change.



Hydraulic Elevating Table Operated by Foot Pedal

Short, easy strokes on a foot pedal operate the hydraulic elevating table developed by Lyon Iron Works, 587 Madison St., Greene, N. Y. This table is useful in moving dies in and out of presses, in lifting or supporting overhanging work on drill presses and in transferring heavy materials or parts from one machine or work bench to another.

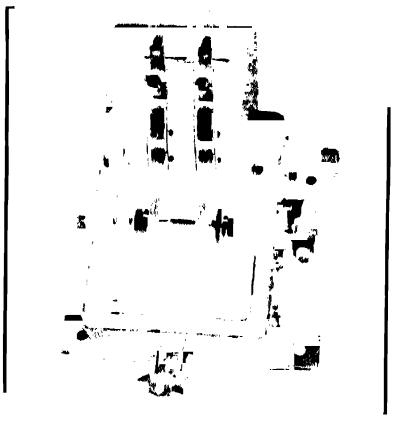
Elevating and lowering by means of foot pedals leaves the operator's hands free for the work. Table is guided so that it cannot swivel. Base is the same size as the table, allowing the table to be pushed up close to a machine without any interference from the base. Casters are located at the extreme corners, giving maximum stability. Table measures 24x30 in. Lowered height is 28 in.; elevated height is 42 in. Capacity is 2,000 lb. Weight is 350 lb.



Cam-Operated Limit Switch Built for Control Circuits

The XC-23 cam-operated limit switch with contacts arranged to swing open for easy inspection and maintenance has been designed especially for control circuits of such devices as hoists and industrial trucks by Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa. This switch is available with ratings of 2 amp. at 600 volts d.c. and 25 amp. at 110 volts a.c. It has two contacts, either or both of which may be normally closed or normally open.

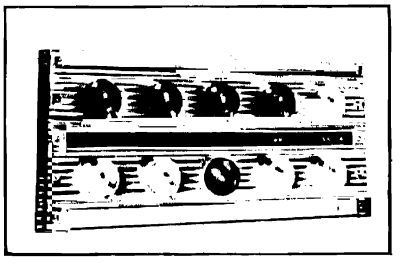
A special feature of the switch is the Micarta fingerboard on which the contacts are mounted; it swings upward out of the case for easy connecting, inspection and maintenance. The switch is housed in a sheet steel weatherproof case. Operation is by a camshaft on which rollers travel. These rollers make or break contacts at any point on the travel. The switch may be actuated either by a revolving shaft coupled to its camshaft, or by movement of an operating lever attached to the camshaft. Moving contacts are self-aligning, with a compensating operating finger.



Standard Mounting Strips Introduced by Kirkland

To facilitate use in multiple of signal lights, toggle switches and pushbuttons, H. R. Kirkland Co., Morristown, N. J., has developed a line of standardized mounting strips. These strips are similar to those used in the construction of telephone switchboards.

They are of stainless steel, with a rippled finish and beveled ends. Strips are furnished with all devices mounted on them, ready to install They are available in three lengths, to contain two, three, or five units per strip. There is a designation strip to match each length



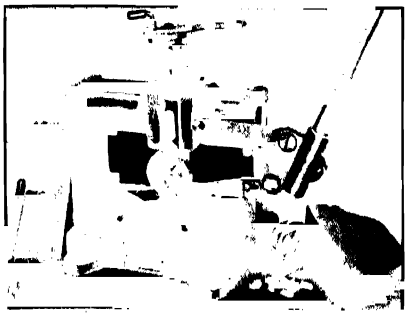
Goggle Safety Shield Developed by Kimball

Kimball Safety Products Co., 7314 Wade Park Ave., Cleveland, Ohio, has developed a cellulose acetate side shield for use on workmen's spectacle-type protective goggles. The purpose is to provide added pro-



tection against particles getting into the eye from the side, while at the same time not interfering with vision

The shield is inexpensive, yet durable. It is easily applied or replaced by merely slipping it on over the temple or ear piece. It is available either clear or tinted



Bates Marking Machine Stamps Irregular Parts

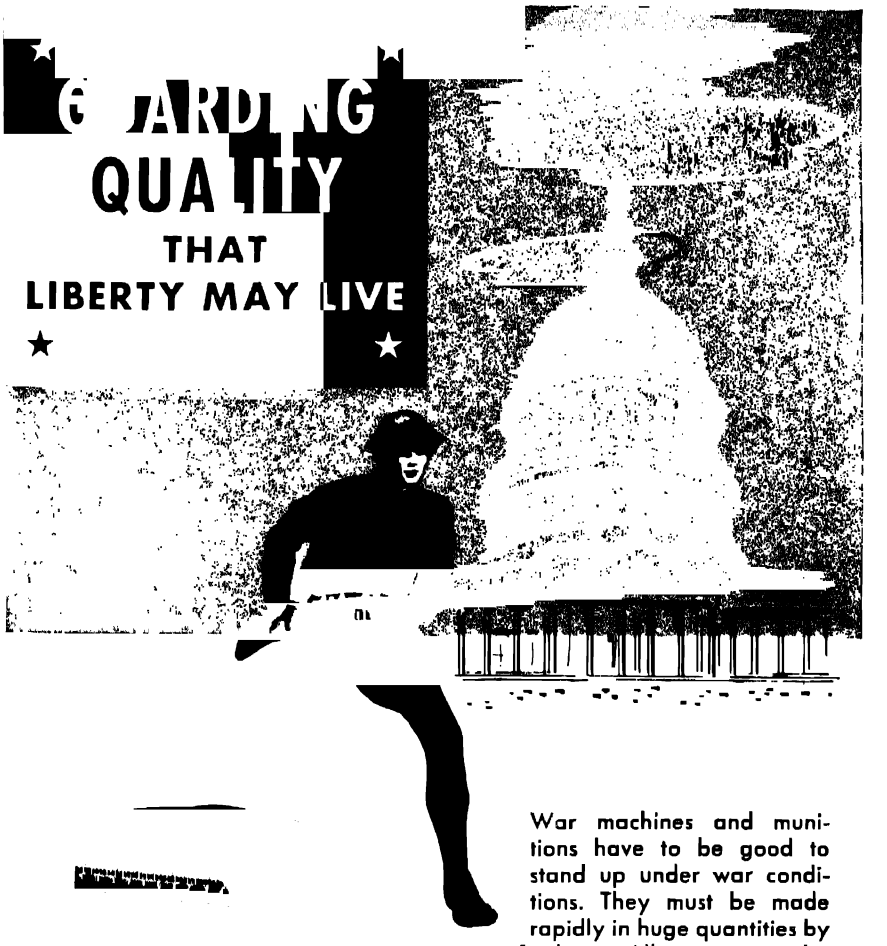
Round, flat and tapered articles can be marked with the No 9 marking machine developed by H O Bates, (The Acromark Co) 245 N Broad St, Elizabeth, N J This device is capable of marking names, specification numbers and other information on a variety of sizes and shapes of parts Marking area is sufficient to take parts up to 10x4 in. For round pieces the product is rolled as a flat die impresses the mark For flat parts the impressions are made with a roller die Holders take steel type for solid lettering dies and are quickly interchangeable for any marking

Inconvenient Places Lighted By Emeloid "Mekanix-Lite"

Lucite plastic is used in the "Mekanix-Lite" offered by Emeloid Co, 287 Laurel Ave, Arlington N J The well known property of this plastic of transmitting light through a curved rod permits the spotlighting of hard-to-see places and loca-



tions difficult to reach Lucite adapters come in several shapes, one of which has a permanent magnet at the outer end with capacity to lift ¼ oz Adapter, which is claimed to be practically unbreakable, threads into the end of an ordinary battery-operated flashlight



War machines and munitions have to be good to stand up under war conditions. They must be made rapidly in huge quantities by a variety of plants. All parts must be strictly interchangeable.

Hence the task of guarding quality becomes a matter of life and death importance to a nation rearming to preserve its liberty.

Sheffield Visual Gages are stalwart guardians of dimensional quality. They are used in checking dimensions of manufactured and purchased parts, tools, production and master gages.

The sturdy Reed Mechanism, combined with the light beam lever arm, provides a sensitivity to meet the highest precision standards of measurement—but without the delicate fragility so often associated with sensitivity.

These gages are not delicate, they are strong and deadly accurate. They are made in various models to check accurately to thousandths, "tenths" or millionths of an inch and all provide rapid, easy gaging to any limits required on production work.

Write for information.

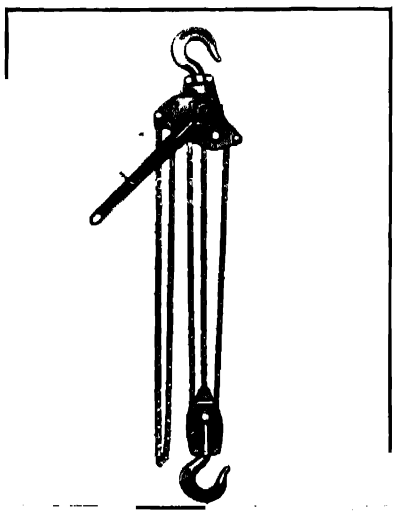
GAGE CORPORATION • DAYTON, OHIO, U.S.A.

MASTER GAGEMAKERS

New "Pul-Lift" Hoist Has Capacity of 4½ Tons

The "Pul-Lift" portable hoist announced by Philadelphia Div., Yale & Towne Mfg. Co., 4530 Tacony St., Philadelphia, Pa., has a capacity of 4½ tons. Great strength with light weight is achieved through the use of alloy steel.

The roller chain is specially designed and has an ultimate strength nearly five times the rated capacity of the hoist. A feature of the device is that it operates equally well in



horizontal or vertical positions.. Thus it can be used for both pulling and lifting and is suitable for almost any type of maintenance job. For operation in close quarters, it has a ratchet handle with a universal action. Short, easy strokes at any point within a complete circle permit operation. Possibility of flying handle is decreased to a minimum by a self-actuated load brake.

Toggle Clamp Templets Offered by Detroit Stamping

To save the time of tool designers in figuring and detailing toggle clamps for holding parts in production fixtures, Detroit Stamping Co., 343 Midland Ave., Detroit, Mich., is giving away sets of templets, scaled precisely to the new toggle clamp dimensions. Eighteen separate templets are provided, ranging from light up to air operated heavy duty models. Each is reproduced on hard finish parchment paper.

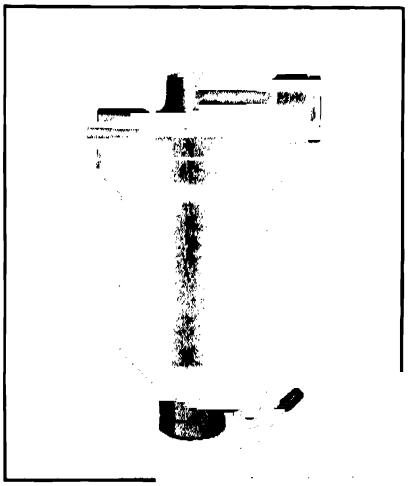
Hygrade Sylvania Announces 200-Watt Fluorescent Fixture

Hygrade Sylania Corp., Salem, Mass., has developed 200-watt "Miralume" fluorescent lighting fixture which makes use of four 40-watt fluorescent lamps, either daylight or white. This No. C-205 fixture is 49 in. long, 14½ in. wide, and 7½ in. deep, and weighs approximately 45 lb. It is provided with plastic diffusing panels and bottom louvres.

DeVilbiss Automatic Drain Used on Compressed Air Lines

Type HOD automatic water drain for use in compressed air lines, claimed to be simple in construction, positive in action, and trouble-free in operation, has been developed by DeVilbiss Co., Toledo, Ohio. This device, available with four convenient fitting assemblies, automatically drains the air line or air receiver, preventing water from being carried into the tool being used. It thereby prevents rusting and corroding, and assures an air supply free from moisture. Its use is especially desirable in spray painting, where it insures against possible moisture deposit on freshly finished surfaces.

The unit operates antomatically by slight fluctuation of the main line air pressure. A variation of as little as 5 lb. is sufficient. A manual drain is provided for use in periods when the main air line is not in use.



Haynes Stellite Announces "Star J-Metal" Alloy

"Star J-Metal" is the latest cobalt-chromium-tungsten metal-cutting alloy announced by Haynes Stellite Co., 30 E. 42nd St., New York, N. Y., a unit of Union Carbide & Carbon Corp. Thorough tests on production jobs prove these tools to be a substantial improvement over the former standard grade of Stellite "J-Metal" in life between grinds. It is recommended for all machining operations on cast iron, semi-steel, steel, or other materials. The new tools can be operated under the same conditions as the original grade and are ground with the same wheels, at the same speeds and feeds. Tool life between grinds is, however, substantially longer. In some cases, improvement in cutting quality makes possible higher speeds and feeds.

"De-Ion" Circuit Breaker Handles Heavy Loads

The Type DH "De-ion" air circuit breaker, designed especially for indoor circuit protection in industrial plants by Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., is available in ratings from 100,000 to 250,000 kva. interrupting capacity; 600, 1200, and 2000 amp. for operation on 2500 and 5000 volts, three phase, 60 cycle power. Features include inlaid silver-to-silver main contacts; arcing contacts of special tungsten alloy; and isolation of high voltage and control circuits.

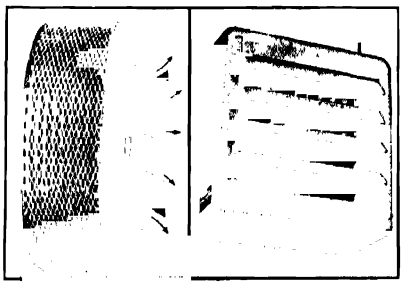
Closing operation is of the solenoid type, with a mechanism mechanically and electrically trip-free. Contact opening is accelerated by springs. Principal advantage of this construction is its high speed, resulting in only a half cycle of arcing at most current values.

Potassium Cyanide Made In U.S. by du Pont

Manufacture in the United States of potassium cyanide, a strategic chemical employed in hardening tool steels, has been announced by R. & H. Chemicals Dept., E. I. du Pont de Nemours & Co., Wilmington, Del. This chemical was formerly imported, but none of the imported material is now available. In addition to its importance in heat-treating steel, the material is valuable in electro-plating metals.

"Murco" Unit Heaters Made In Two Types

D. J. Murray Mfg. Co., Wausau, Wis., has developed the M Series "Murco" unit heaters in both standard and vertical projection types. Design of

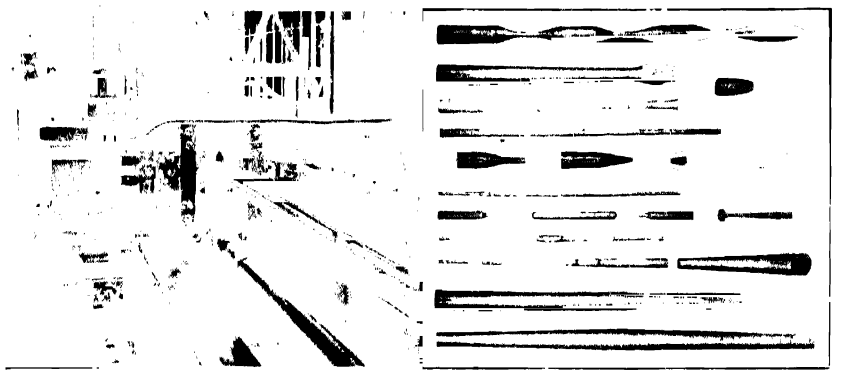


the individual copper spiral fin tube core provides even air distribution at high velocity. Individual tubes prevent stresses due to unequal expansion.

Entire unit is spring suspended and floats free in the casing, thus eliminating rigid connections between the cabinet and unit. Heaters are made in 27 models for steam, and 8 models for hot water. Each type of heater is finished in baked crinkle enamel

NEW MATERIALS

Long Lengths of Tapered Tubing Made Possible by Dewey Tube-Forming Process



Tubing with tapers up to 20 ft. long or with any combination of tapers and curves in the same length, with reductions in diameter up to 50 per cent, are possible with the Dewey tube-forming process developed by Steel & Tubes Div., Republic Steel Corp., Cleveland, Ohio. Thus are opened up new possibilities for economical use of tubing. For example, tubular automotive propeller shafts can be made a constant-strength beam by tapering from the ends to the center, instead of tapering for only a short distance from each end. Aircraft landing gear struts can follow similar design, instead of using a stamped and welded assembly.

In machines using the Dewey process, tubing is passed through a closely fitting bushing mounted on a transverse forming carriage, its ends being gripped in headstock and tailstock chucks. Headstock chuck is turned by power, the tailstock chuck running free. Headstock is pulled along the ways by a hydraulic piston to keep the tube under tension and take up its increase in length as it is reduced. Forming carriage moves from tailstock to headstock, the centralizing bushing engaging the tubing just ahead of the forming rolls which move radially, their motion controlled by a templet bolted to the machine bed. Roll housings are geared together so that one templet actuates both rolls at the same time.

Machine shown handles tubing as heavy as No. 8 gage up to 4 in. in diameter. When forming 2-in. tubing, wall thickness ranges from 20 to 10 gage. Percentage reduction depends on analysis. On boiler tubing, reduction has reached 50 per cent. For brass and Monel, reduction may be 60 per cent of the original diameter. Either welded or seamless tubing can be handled, but it must be free from flaws. It should also be uniform in temper to within usual commercial limits.

Wall thickness is affected by the roll-face radius, the axial load applied to the tubing, and the rate of feed of the forming roll carriage. A sharp roll face radius thins the metal at points of severe reduction. A wider radius thickens it. Control of axial loads and roll feeds permits the metal to be displaced within wide limits. It is possible to control thickness of all portions of the work. Scrap is low, being only the few inches at each end required for chucking.

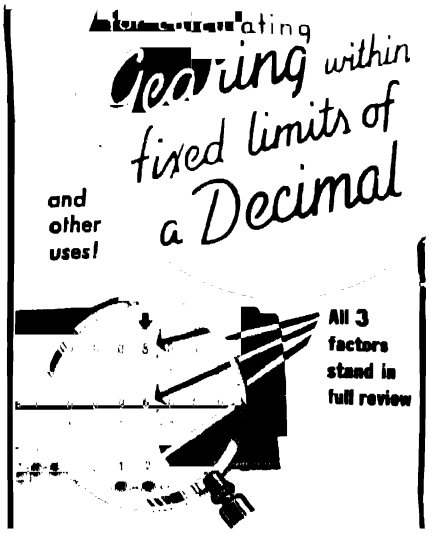
"Castolin" Brazing Alloys Melt at Low Temperatures

"Castolin" low-temperature welding and brazing eutectic alloys, formerly imported into the United States, are now being manufactured by Eutectic Welding Alloys, Inc., 40 Worth St., New York, N. Y. These metals, available in a full range of special alloys in rod form, are said to make use of a new eutectic binding technique. Absolute fusion of molten rod with heated surface is claimed to be easily achieved.

"Durez 1910" Plastic Has High Impact Strength

Known as "Durez 1910," a high-impact phenolic molding compound developed by Durez Plastics & Chemicals, Inc., North Tonawanda, N. Y., is the third in a series of "1900" compounds having a particle size making it convenient to handle in hoppers and feeders.

Containing quantities of graphite this material was developed especially for such applications as bumper shoes, refrigerator lock bolts



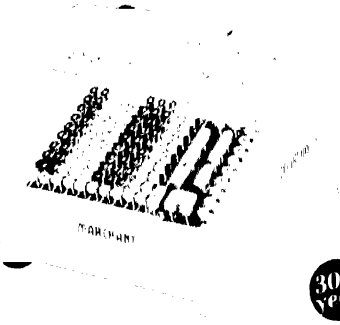
MARCHANT

the electric calculator with straight-line true-figure dials for ALL 3 FACTORS

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American Gas Furnace Co.

and other parts where minimum frictional resistance is desirable.

Previous impact-resistant materials of this type have been of very fluffy consistency and were difficult to handle in feeders and hoppers. "Durez 1910" has a particle size comparable to dry rice and may be preformed easily. It flows freely through standard feeders. Specific gravity is 1.45. Bulk factor is 3.6:1.

Jessop "773" Tool Steel Possesses Unusual Toughness

A medium-carbon manganese-molybdenum steel, known as "773" tool steel, has been added to the line of cutting materials offered by Jessop Steel Co., 595 Green St., Washington, Pa. This steel is said to possess unusual toughness, making it suited for use in tools, dies, punches, cutting tools, chisels, etc., and for a variety of applications where exceptional toughness in thin sections, as in step-down dies, spatulas, scraper knives, etc., is required. A $\frac{1}{4}$-in. section in the hardened and drawn condition (58 Rockwell C) takes a permanent set without cracking or bending.

Bronze Welding Rod Has High-Test Flux

Air Reduction Sales Co., 60 E. 42nd St., New York, N. Y., has developed a high-test flux-coated bronze welding rod claimed to offer advantages of low fuming, faster application, denser deposit, increased tensile strength, greater bond strength, increased hardness, improved ductility and saving in time. It is claimed that this flux adheres well in shipment and in use, and that it will not fall off if the rod is bent excessively. For those who prefer a bare welding rod, the same flux is available in liquid paste form.

TRADE PUBLICATIONS

AIR CIRCUIT BREAKERS A 12-page illustrated catalog which lists and describes "De-ion" air circuit breakers for load center, panelboard, switchboard or inclosure mounting is circulated by Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

AIR CLEANER Four-page folder, No. F-8501, published by Westinghouse Electric & Mfg. Co., Edgewater Park, Cleveland, describes the operation of the "Precipitron," an electrostatic air cleaner.

BLOWERS Roots-Connersville Blower Corp., Connersville, Ind., has issued a new bulletin, No. 21-B-35, which describes the construction and operation of rotary positive blowers for handling small and medium volumes of air against pressure or under suction.

COMPRESSORS Worthington Pump & Machinery Corp., Harrison, N. J., has published a 6-page folder which illustrates the operating features of roller bearing compressors for refrigeration.

CUTTING MACHINE Air Reduction Sales Co., New York, N. Y., has published an 8-page booklet which describes the operation and specifications of the "Radiagraph," a portable motor-driven gas-cutting machine.

CUTTING MACHINES Air Reduction Sales Co., New York, is circulating a 15-page booklet which describes the construction and operation of gas-cutting machines for marine construction.

ENGINES Caterpillar Tractor Co., Peoria, Ill., has just issued a 32-page booklet which lists the capacities and mechanical features of each of the eight sizes of Caterpillar diesel marine engines.

HOBBING MACHINES Barber-Coleman Co., Rockford, Ill., has published Bulletin No. F-1410-1, which covers special units and accessories for standard and precision hobbing machines.

LIFTERS A 32-page catalog prepared by the Economy Engineering Co., Chicago, describes all types of lifting and hoisting devices for use in factories, warehouses, stores and machine shops. Details of construction are explained and sample specifications are given.

OIL CIRCUIT BREAKERS An 8-page illustrated bulletin, No. 33-600, circulated by Westinghouse Electric & Mfg. Co., contains a general description of oil circuit breakers designed especially for indoor industrial and central station use.

PRESSURE GAGES Brown Instrument Co., Philadelphia, has just published a new catalog, No. 6706, which covers a complete line of vapor-actuated thermometers and pressure gages.

PUMPS International Nickel Co., Inc., New York, N. Y., has just published an illustrated booklet containing comprehensive information on pumps and parts.

TURRET LATHES Jones & Lamson Machine Co., Springfield, Vt., has published a book, "Turret Lathe Earning Power," in which answers are given to fundamental questions that form a basis for comparison of turret lathes and their relative values.